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THE IMPACT OF LOCAL GOVERNMENT POLICIES
ON LAND VALUES AND APPRECIATION
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George McClellan Johnston

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W. Allan Schmid

Major professor

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THE IMPACT OF LOCAL GOVERNMENT POLICIES
ON LAND VALUES AND APPRECIATION

By

George McClellan Johnston

A DISSERTATION

Submitted to
Michigan State University
in partial fulfillment of the requirement
for the degree of

DOCTOR OF PHILOSOPHY

Department of Agricultural Economics

1980

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ABSTRACT

THE IMPACT OF LOCAL GOVERNMENT POLICIES ON LAND VALUES AND APPRECIATION

By

George McClellan Johnston

The land conversion process, which creates the shape and environment of urban, suburban, and rural areas, raises specific concerns related to agricultural land retention, the cost of public services, and environmental issues associated with urban sprawl. Key performance variables in this process are residential site prices and appreciation of land values over agricultural opportunity costs and site development costs. There are significant differences in appreciation across metropolitan areas. Appreciation can be considered a measure of economic rent and profit. Local government policies can create economic profit for landowners by restricting land supply for certain uses.

Specifically the question is whether differences in site prices and appreciation across metropolitan areas can be explained by zoning, sewer provision and pricing, and property tax policies. These policies, in the aggregate, can restrict land supply and change the pattern of land use. Furthermore, depending upon the variation in policies from one jurisdiction to another, greater supply restricting policies, such as low density zoning, can increase the appreciation and economic profit throughout a metropolitan area, without changing the relative prices across jurisdictions. Also, competition for appreciation not only raises housing costs, but also puts great pressure on land use plans.

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The economic and institutional interdependence of local government jurisdictions is an integral part of examining the hypotheses.

The zoning hypothesis stated that the greater the percentage of low density residentially zoned land in the land conversion market, the greater would be appreciation and site prices. The sewer provision hypothesis stated that the greater the percentage of land where sewer provision is controlled or restricted, the greater would be site price and appreciation. It was also noted that under-supply should increase appreciation, while over-supply would increase price but lower appreciation. Other policies such as septic tank regulations could also ameliorate the hypothesis. Furthermore, the greater the percentage of subsidization of sewer services, the greater would be site price and appreciation. Property taxation effects on holding costs and property values were examined but no specific hypotheses were developed because of the complexity of the variable.

The theoretical model was examined in a cross-sectional regression model, a pooled cross-sectional time series regression model and a comparative case study of Lansing, Kalamazoo, and Jackson, Michigan. Site price and appreciation data from the National Association of Home Builders and the Federal Housing Administration were the dependent variables. The independent variables in the econometric analyses included the demand variables analyzed in earlier research, site characteristic variables, and instrumental variables (such as percent all or new homes sewered and the property tax range, a proxy for variation in property taxes across jurisdictions. The comparative case study, which included developer and planner interviews, examined

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operational difficulties with zoning as well as the applicability of the econometric results to detailed metropolitan situations.

The weight of the evidence supports the conclusion that zoning, sewer, and tax policies can increase site prices and appreciation. The econometric results demonstrated a consistent statistical significance for agricultural opportunity costs, percent all homes with public sewer, and to a lesser degree, the property tax range. These results varied between data sets and were less stable over time, as tested in the pooled regressions. The comparative case study results supported the general hypotheses by noting developer and landowner behavior, but raised questions about the operational definitions of the variables used in the econometric analyses.

Policy implications suggest that preferential agricultural tax policies lead to increased appreciation, as well as, in the aggregate, zoning and sewer supply policies which restrict certain kinds of development. Further quantitative analysis requires better data for both the dependent and instrumental variables.

DEDICATION

To my parents, George and Mildred Johnston,
for their understanding and encouragement.

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I sincerely thank all of those who made my time at Michigan State one of significant growth and change.

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CHAPTER I

INTRODUCTION

There are many facets to the process which creates the shape and environment of urban and surrounding suburban and rural areas. Schmid's Converting Land From Rural to Urban Uses noted that, "There is a large and growing residual land value contributing to high lot prices which is not explained by agricultural opportunity costs, lot size, improvement costs, or general inflation." (1968, p.12). This thesis reexamines this residual land value, or land value appreciation, as well as site prices, using the economic theory of rent and profit. Specifically the question is whether differences in site prices and appreciation across cities can be explained by such local government policies as zoning, sewer provision and property taxation. Understanding the role of these policies in the land conversion process should also enable a better grasp of such issues as agricultural land retention, the cost of public services, and other environmental issues associated with urban sprawl.

A recent Department of Housing and Urban Development report highlights the timeliness of the issues examined in this research.

Much of the increase in housing costs is directly attributable to a steady rise in the cost of the serviced site. A survey by the Urban Land Institute of developer members in seven metropolitan areas found an average increase in urban land prices between 1970 and the spring of 1974 of 100 percent. This is an average annual rate of increase of 20-30 percent for the period, compared to an increase of 8-10 percent between 1958 and 1970. The Department of Agriculture found that the average value per acre of farm land--a prime source of developable lots--had almost tripled between 1967 and 1977.

Nationally, the developed lot now accounts for about 20 percent of the cost of a typical single-family house with FHA mortgage insurance, compared to about 15 percent in 1960. In areas with stringent land use regulations, ratios of 30 percent are not uncommon for conventionally financed development. Discounting inflation, consumers are getting less housing for their dollar because they are paying proportionately more for the site.

There are three major reasons for this increase in the cost of sites:

- (1) Constraints in the supply of developable lands;
- (2) High site development costs; and
- (3) Procedural delays.

In many areas the supply of developable land has been constrained in part by limitations in the capacity of public facilities--especially water and sewer--and by restrictions on the use of land through zoning and related controls. Rapid increases in site development costs have been caused by higher governmental standards and fees. Procedural delays have resulted from the proliferation of governmental regulations affecting land development. (HUD, May, 1978, p.13)

The interdependencies between local government jurisdictions on one part of a land conversion market with decisions taken by other local government jurisdictions can affect the land conversion process and site price and appreciation, in particular. As Clawson noted, "the use and value of any tract or parcel of land within a metropolis is affected more by the use and value of other tracts or parcels of land than it is by what takes place on the tract itself." (1971, p.174) Much of the focus of research to date has been on the implications of various local government policies on a particular piece of land or category of use. The unit of observation of this research is the land conversion market of non-residential to residential uses, in the aggregate, across cities.

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The land conversion process tracks land from active farm value to the price paid for a residential lot. The steps in this process include the speculative price paid to the farmer, the price paid by the subdivider, and the costs of developing the lot for residential use. The land conversion market would, therefore, reflect land in different stages of development. The land use pattern would be mixed and, generally, on the fringe of urban areas.

The role of local government policies in explaining land value appreciation and site price across cities is explored in a model using economic rent and profit theory. This is presented in Chapter II. This model specifically accounts for interdependencies between policies followed by local governments which affect the supply of land for urban residential uses. It is argued that local government zoning, sewer provision, and property tax policies which restrict the supply of land for residential uses can create economic profit and increase land value appreciation and, hence, the prices paid for a residential site. The competition for this economic profit can also create pressure on local development plans which also affect the shape of urban areas and the monetary and non monetary cost of the land conversion process.

Chapter III surveys and critiques earlier empirical research on inter-urban land values. These econometric studies are reviewed on the basis of the form and geographic definition of the dependent variables and the kinds and definition of the independent variables. In addition, the issues raised and techniques used by the two most recent studies are compared.

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Chapter IV develops the dependent variables used in this research; site price and appreciation. In the initial discussion of site prices across cities, the most commonly used dependent variable in earlier research, a comparison is made of the two sources of site price data, the Federal Housing Administration and the National Association of Home Builders. Next, the data and calculation of appreciation are reviewed. This includes data on site size, development costs, and agricultural opportunity costs. After a brief comparison of site price and appreciation data and calculations using the two data sources, the chapter concludes with a summary of the land conversion process which reestablishes the importance of site price and appreciation as operational measures of economic rent and profit.

Chapter V is the first of three chapters on the econometric regression research of this thesis. This chapter begins by operationalizing the independent variables. There are three groups of independent variables: demand variables, site characteristic variables, and instrumental variables designed to test the theoretical model. The first section concludes with a formal statement of the operational models for site price and appreciation. The rest of the chapter uses cross-sectional regression analysis of these models. A short test of sewer financing data is also included.

Chapter VI is a pooled cross-sectional and time series regression analysis. This model adds a time dimension and applies various forms of a covariance model. This chapter is designed to examine the stability of cross-sectional relationships over time using different

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independent variables over various time periods, depending upon data availability. Chapter VII summarizes and analyzes both the cross-sectional and pooled cross-sectional, time series regression chapters.

Chapter VIII is a comparative case study of Lansing, Kalamazoo, and Jackson, Michigan. Data and interpretations of the econometric analysis are compared to primary and secondary data and information developed on zoning, sewer provision, and property taxation. This included interviews with planners and developers in these cities. In particular, zoning is analyzed in much more detail than possible in the econometric chapters. Furthermore this chapter deals with the problems which arise from the use of national data when applied to case studies.

Chapter IX, the conclusion, will analyze the results of both the econometric and comparative case study chapters with respect to the general model proposed and the specific hypotheses presented. The focus of the chapter is to respond to the issue of what people should support in terms of instrumental government policies if they want to keep prices and appreciation down. This includes both policy and research suggestions.

To summarize, the next chapter will develop a theoretical model and will be sequentially followed by a literature review, development of the dependent variables and further clarification of the problem, definition of the independent variables and a cross-sectional regression model, a pooled cross-sectional, time series regression model, conclusions drawn from the regression results, a comparative case study, and, finally, the summary conclusions of the thesis.

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CHAPTER II

THE ECONOMICS OF THE RENT AND PROFIT

SEEKING SOCIETY

Introduction

This chapter conceptualizes the problems and issues of interest in this research. The conceptual framework, per se, will be described only briefly. The nature of economic rent and profit within this framework will then be described. The next step presents the theoretical linkage between each of the instrumental variables and economic rent and profit. Effectively, this chapter presents a causal model of the relationship between zoning, sewer provision, and taxation, the instrumental variables, and economic rent and profit. All subsequent chapters relate to the operationalization and measurement of this model.¹

Overview of the Situation-Institutions-Behavior-Performance Model

This research will apply the situation-institutions-behavior-performance model for the analysis of community issues.²

¹The data or information system model, which includes the conceptualization, operationalization, and measurement steps, is discussed in Bonnen (1975).

²This model is elaborated in Schmid (1979).

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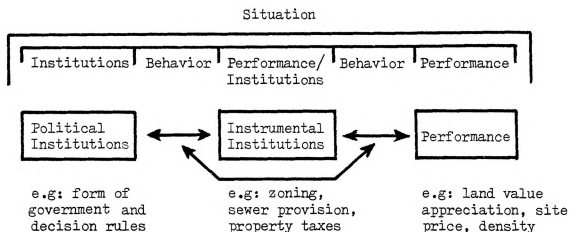
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FIGURE 1: CONCEPTUAL FRAMEWORK OF THE SITUATION-INSTITUTIONS-BEHAVIOR-PERFORMANCE MODEL



This figure can be described briefly as follows. Defining the situation entails describing the varieties of interdependence, historical setting, and degree of conflict or harmony. If scarcity is assumed, there is interdependence. Property rights define whose interests are to count. Particular relationships are defined via the situation and constrained by property rights. These property rights are the institutions which were defined by John R. Commons as "collective action in control, liberation and expansion of individual action" (1950, p.21).

For example, rents and opportunities for gain are distributed among different groups according to the rules of the game. Inelastic supply of land means that market competition does not prevent returns or profits above costs of production (opportunity cost). If the performance desired by the individuals wanting to get the land value appreciation is achieved, then others must bear some costs in terms of land use patterns in addition to the cost of housing.

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Because scarcity and interdependence are assumed there are individuals and groups who want different performances than what they are now getting. These interests may be frustrated by the ability of those wishing to manipulate the process to get profits. Regardless of who wants what, this indeed seems to be the result. The capture of these profits is a type of pecuniary externality which in the case of zoning, sewer and taxes are politically created.

The political institutions consist of the form of government and the decision rules which affect who gets to choose policy and use of resources. The behavior of the individuals or groups within this structure affects the performance of the local government; for example, the specifics of zoning, sewer provision and taxes. These policies then consist of the instrumental institutions or structure which affect the behavior of the participants in the land conversion market and what will be considered here as the categories of performance of interest; land value appreciation and site price.

The presentation of the model will begin with defining the situation and final performance, site price and appreciation. From final performance the instrumental institutions and then political institutions will be discussed. The rationale for this approach is that while the political rules which define who has access are important in determining performance, that importance is reflected in the choice and administration of the instrumental institutions. If the instrumental institutions cannot be shown to influence the chosen performance variables, then the role of political institutions on performance will be speculative.

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Economic Rent and Profit

Rents are defined as returns above costs of production resulting from natural limitations in supply. The supply of a particular variety of land is inelastic. By way of contrast, returns arising from non-natural limitations are termed excess profits or quasi rents. Normal profits, on the other hand, include the payments necessary to draw forth the required entrepreneurial and capital resources. These definitions are not without argument in economics and the literature is rather huge (Keiper, et.al., 1961, Gaffney, 1961; Currie, Murphy and Schmitz, 1971, Lackman, 1976; Lackman, 1977; Edel, 1978). One criticism is that this definition may ignore some of the nonpecuniary rewards the factor owner may receive (Currie, Murphy and Schmitz, 1971).

The implication of economic rent is that, unlike profits, rent cannot be competed away. Factor ownership controls who gets the rents. Monopoly conditions which lead to profits such as limiting firm entry can be dealt with by increasing competition.

Land on the urban-rural fringe appreciates without any productive effort on the part of owners of the land. There are, therefore, incentives for landowners to compete by favoring increased development, in general, and development on their land specifically. This puts pressure on any development control plans which may exist. The results may be associated with urban environmental characteristics under the rubric of sprawl: expensive public services, mixed "uncomplementary" land uses and a leapfrogging land use pattern.

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Land value appreciation may represent something more than the present value of future rents. Monopoly returns or profits could also be a portion of this appreciation. Whether monopoly profits are indeed a component of appreciation is the central issue of this dissertation.

The profit component of land value appreciation could arise from either local government or private supply restrictions. This research is primarily interested in public supply restrictions. Examples include zoning land for large lots, controlling (limiting) sewer provision and public tax and pricing policies.

Overt private supply restrictions, which could lead to monopoly conditions such as ownership of land by a few people, are not readily evident. However, there do appear to be variations between cities in the degree of concentration of ownership (Markusen and Scheffman, 1977). On the other hand, private supply restrictions exist if the owner of a resource naturally limited in supply, acting independently, withholds land from the market in expectation of increasing prices. This reservation price functions as a monopoly but, as Breimyer (1978) noted, it is a monopoly without monopolists. This reservation price could vary across cities because of local government policy effects on landowner expectation.

Operationalizing economic rent and profit in this research will involve using site price and appreciation. Site price captures more than economic rent and profit. It also includes development costs, agricultural opportunity costs and some variation in site size. Much of the earlier research used this variable and its use in this

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research allows some continuity with that research, as well as permitting a check and a contrast with appreciation. The calculation of appreciation, while rough, is designed to eliminate factors not related to economic rent and profit. Differentiation between economic rent and profit will be attempted.

Instrumental Variables

Introduction

Instrumental variables are variables which are subject to some form of political decision and this can be changed by the instrumental variables. Zoning was selected because it has been considered the most direct policy instrument in controlling land use. Sewer provision and pricing were selected as examples of the effect of various public service policies. Also increasing water pollution concern and regulation indicates an enlarged role for sewer policy. Transportation was not investigated because it was believed that much of the important part of the transportation system is in place (Tabors, et al, 1976). This may not be the case if mass transit systems expand. Certainly the energy component will be different. Finally, taxation is explored because of its interactions with both zoning and public service provision rather than any strong belief that either the theory or research would give much light to the conceptual, operational, or measurement problems inherent in taxation.

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Zoning

Zoning involves the designation of specific land use districts within which various regulations and restrictions apply, such as permitted uses, proportion, and size of lot, maximum height and bulk requirements and population density limits. Districts can be classified into numerous categories: residential, business, industrial, agricultural, recreational, unrestricted, etc. The residential classification can be further broken down into various categories such as single family, multiple family, and apartment building districts. Zoning could be exclusive, allowing one use, or cumulative zones which allow the previously defined uses in addition to its own designation. Implementation and form of these powers can vary between jurisdictions within a state and within a metropolitan area.

It is argued that the competition for economic rent places great pressure on the development plans of communities. Zoning has long been associated with corruption arising from rent competition (Clawson, Held, and Stoddard, 1960; McCahill, 1973).³ Economists, however, have

³Externality is conceived by some economists narrowly as uncompensated benefits or costs not taken care of by the operation of the market or an effect of one economic agent on another which is not taken into account by the first agent when he decides on his actions. Others such as Samuels defined it as follows: "Externalities comprise the substance of coercion, namely, the injuries and benefits, the costs and gains, visited upon others through the exercise of choice by each economic actor and by the total number of economic actors." (Samuels, 1972 p. 64) This definition makes externality synonymous with the concept of interdependence. Since this research attempts to specify the nature of interdependencies more carefully, the notion of externality will be used only as a reference to the usage of the term in the review of work done by some economists.

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generally been concerned with zoning from a fiscal or externality framework. Research in this area has often shown zoning to have no effect on the externalities being tracked (Crecine, Davis, and Jackson, 1967; Maser, Riker, and Rosett, 1977). Externality and fiscal zoning are segregated as follows. Externality zoning arises when one person's land use has an effect on neighboring land. Fiscal zoning usually implies not solely the separation of land uses implied by externality zoning, but an orientation to different goals such as low property taxes or high property taxpayer residents. Exclusionary zoning designed supposedly to keep certain land uses out of a community could arise, given the common understanding of the first two definitions, from either of the above or be the basis of motivation for either.

Zoning has been considered most effective in inhibiting changes which have adverse effects on other users in well established areas. The initiator of change is opposed by those who stand to suffer losses. According to some, zoning has also provided the device for protecting the homogeneous, single family suburbs (Babcock, 1966).

Zoning, however, has not been considered to be successfully administered to control the speed, direction and final character of the land conversion process (Clawson, 1971). It has not been considered effective in keeping out land uses incompatible with plans for the development of new suburban areas. Those who compete for the gains from land uses other than those permitted will attempt to change the zoning. Nevertheless, there are suburbs where low density

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residential zoning is strongly supported by residents and public officials (Babcock, 1966).

The relationship of zoning to land values and land uses in the land conversion market is affected by the degree to which the zoning of political jurisdictions in the market, in the aggregate, affect the supply of land for different uses. For example, if one jurisdiction allows diversity of uses while nine jurisdictions try to inhibit any development other than low density residential uses then the increased competition for the areas available other than low density will drive those prices up while the price of the zoned low density land, which is over-supplied, will depend upon the price elasticity of demand for that particular use, expectations, etc.

Minimum lot size requirements can serve as an example of what can be expected from variables designed to affect the size of lots. Some jurisdictions in a land conversion market might contribute to the withholding of land from the market. This reduces supply and raises prices above costs of production. For example, some communities purposely zone available sites only for large lots, hoping thus to reduce government costs in relation to tax revenues. (Mills and Oates, 1975). The process puts a premium on areas that are open to small lot development or for multi-family units. If too little land is zoned for small lot development, there could be leapfrogging developments and a leapfrogging pattern of land acquisition. Thus large lot zoning would not only use up more land and at a lower density, but it would also contribute to supply restrictions for other residential construction. This would increase the appreciation on high density zoned land

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and decrease the overall density of land. The large lots overzoned could be a differentiated product with higher quality features which could potentially be sold by the developer to customers at a higher price.

Ohls, Weisburg and White in an article on "The Effect of Zoning on Land Value" argued that zoning could either raise or lower aggregate land values. On one hand they argue:

Fiscal zoning enables suppliers of land to act in discriminating monopolist fashion. They can charge a high price in that submarket where demand is inelastic by using zoning to restrict supply and channel the left-over supply into the market with elastic demand. Furthermore, aggregate land value can be increased even when the two submarkets are interrelated, if demand for the restricted use (in this case apartments) is sufficiently inelastic (1974, p.432).

They also argue that zoning could lower land values depending on the relative elasticities of different residential types. This is consistent with rent theory and indicates the importance of demand in determining economic rent.

Several empirical studies provide data and analysis of zoning effects. The Regional Plan Association's (RPA) study of zoning in the metropolitan New York area is reported in Gold and Davidoffs' report for the President's Committee on Urban Housing (1967) and combined with other research in Sagalyn and Sternliebs' Zoning and Housing Costs: The Impact of Land Use Controls on Housing Price (1971).

The RPA report indicated the following trends: 1) Of the vacant land in the region 75.7 percent is zoned and 90.7 percent of that for residential uses and 99.2 percent of that for single family residential uses hence 8 percent for multiple family housing, 2) "We now see that

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90 percent of the area zoned for single family housing is zoned for lots of one-quarter acre or larger, while two-thirds of the area is zoned for half acre or larger lots" (Sagalyn and Sternlieb, 1971, p.343), and 3) there has been a strong trend to up zone or to increase minimum lot size as an area begins to undergo urbanization. Sagalyn and Sternlieb compared the RPA data with a later survey and found the same strong preference for large lot zoning.

Sagalyn and Sternlieb provide the basis for isolating minimum lot size as a crucial variable in zoning. Their study found minimum lot size statistically significant in explaining housing costs across counties in New Jersey. In addition, minimum lot size was highly correlated with front footage requirements. So while minimum frontage requirements, population density limits and other specific zoning controls may be important, minimum lot size requirements seem likely to capture the intent of the zoning ordinance.

It can, therefore, be hypothesized that low density zoning will have the following relationship to site price and appreciation: The greater the percentage of low density residentially zoned land in the land conversion market, the greater will be the appreciation and site price in that market.

Sewer Provision

Local government practices with respect to public sanitary sewers can also influence site price, appreciation and land use. There are two key aspects.

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One is the level of provision. If the supply of sewers is restricted or controlled, the supply of building sites, given requirements for adequate sewers, will be restricted in that jurisdiction. If policies responsible for controlling sewer supply such as, among others: 1) sewer moratoria, 2) refusal to sewer, or 3) a small land area included in a Service Policy Area are in effect in a large percentage of the land conversion market, developers could be forced into a leapfrogging pattern of land acquisition by moving to jurisdictions which are less restrictive and, perhaps, further from the urban area (Tabors, et.al., 1976). This also increases the price of sewer land, which is in limited supply. Use of septic tanks is becoming more difficult in many areas, primarily because of health department policies (Downing, 1972).

The process could be described as follows. If sewers have been extended to large areas of undeveloped land, developers are likely to buy and construct on large tracts where land is cheaper. The resultant development will be a low gross density and probably a low net density. The rate of development and infilling will depend upon general and relative demand. However, if sewer provision is still further increased because of demands on other areas of the metropolitan area and fringe, complete infilling might never occur. The infilling would also relate to other issues including the zoning by a local jurisdiction. If a suburban jurisdiction is settled with a certain more or less homogeneous group, the zoning may reflect a desire to maintain that homogeneity. This may not be the case where communities on the fringe encourage development. A moderate level of sewer provision might not

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have the same result. Supply of sewerred lots would be somewhat restricted, therefore the price of a sewerred lot is likely to be greater. Demand will determine the price and density. If demand is moderate, prices will not be as great, but density is likely to be lower, though not as low as with over-supply of sewers.

Finally, when much less sewer system is provided than is demanded, the land which is sewerred will be highly priced. If the price is too great, developers may find it reasonable to find cheaper land much further from the urban area where other alternatives such as package sewer plants or septic tanks provide a reasonable financial alternative.

The general hypothesis is as follows: The greater the percentage of land in the land conversion market where sewer provision is controlled or restricted, the greater will be the site price and appreciation.

However, it is necessary to differentiate between restrictions associated with too much or too little sewer provision. Restricted supply, too little, should increase appreciation while over-supplied would increase price because of the sewer component of development cost, but lower appreciation.

Another source of appreciation above agricultural opportunity costs occurs because sewers are provided for less than they cost. A proportion of the value of land is based on the availability of sewers. To the extent that the sewers are limited in supply and made available without or below costs, their value becomes capitalized into the value of the land. For example, sewer service may be provided to new areas at the same price as the central city area even though the cost may be

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higher. It is the owner of the sewerred land who benefits because the sewer services are capitalized into the land values but cost the owner very little.

Schmid noted that, "The asset appreciation reflecting the value of amenities provided in limited supply at less than cost appears as a rent from the developers point of view, but is monopoly profit from the point of view of the whole economy, in that it results from a contrived rather than natural restriction of supply." (1968, p.37)

Clawson elaborated on the issue as follows:

To the extent that the house purchaser evades any of the costs of public services to his property, the raw land price will be higher than if he had to pay them. The house purchaser will have gained little or nothing by evasion of these costs, nor will the builder have gained. Virtually all of the gain from costs evaded by the purchaser will have passed on to the owner of the raw land. To the extent that the house purchaser does not pay all the costs associated with his property, some other taxpayers will have to pay them. (1971, p.162).

Therefore, the hypothesis is as follows: The greater the percentage of subsidization of sewer services in a land conversion market, the greater will be the site price and appreciation.

One caution will be mentioned at this point. Local government policy on septic tanks may affect sewer policies. For example, if septic tanks are restricted, it may either increase density in the land conversion market or perhaps extend the boundaries of the land conversion market to areas where septic tanks are allowed. Subsidized provision of sewers might increase density if septic tanks are not a viable alternative. In addition, the over-building of sewers combined with the subsidization issue should also relate to septic tank or any alternative treatment system by making the use of sewers more attractive.

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Operationalization of this issue is complex. There are three broad categories of revenues used to finance sewage: Service charges, connection fees, and property value taxes.

Service charges are periodical charges to the users of a sewer system, or presumptive evidence of such use. In contrast, connection fees are one time expenditures paid when the user begins service, while property value taxes may be either one time or periodic and vary with the assessed value of the property. Property taxes may be levied against users and non-users. These categories can be further characterized by the type of revenue base used: 1) general revenues, 2) special ad valorem assessments, 3) lot size and frontage assessments, 4) flat rates and modified flat rates charge, 5) user charges based on water use and, 6) user provided facilities. (Tabors, et.al., 1976).

Very limited data is available across metropolitan areas on the use of sewer charges. Some data for 1960 is presented in Table 1. Appendix A contains data for some jurisdictions in metropolitan Detroit.

The issues which arise in the pricing of a joint impact good are varied.⁴ One effect noted in a report entitled Interceptor Sewers and Suburban Sprawl: The Impact of Construction Grants on Residential Land Use was that connection fees forced developers and the local community to attempt to reach their population projections, "without

⁴ Joint impact goods are goods which enter two or more persons' utility irreducibly. The marginal cost of another user is zero over some range. See Schmid (1979, pgs.70-87).

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TABLE 1

PERCENT ALLOCATION BETWEEN PROPERTY TAX AND SEWER
CHARGES FOR SEWAGE UTILITIES. SELECTED
METROPOLITAN AREAS OR UTILITY DISTRICTS
IN THE UNITED STATES, 1960.

Metropolitan Area or Utility District	User Charges (%)	Property Tax (%)
Boston	0	100
Chicago	0	100
Cincinnati	100	0
Cleveland	78	22
Detroit	100	0
Los Angeles Sanitation District	0	100
Milwaukee	0	100
New York	78	22
Philadelphia	100	0
Pittsburgh	100	0
Portland	57.7	42.3
San Francisco	0	100
East Bay Municipal Utility District	60.7	39.3
Toledo	100	0
Washington, D.C.	100	0
Buffalo	37.5	62.5
Green Bay, Wis.	0	100
Madison, Wis.	86	14
Rahway Valley, N.J.	0	100
St. Louis	91.3	8.7

Source: Downing, 1969, p.145.

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new connections, the bonds the area has sold cannot be paid off."

The sponsors of Harkey Creek Interceptor System in Tulsa, Oklahoma financed their system by selling developers debentures which could later be applied only against connection fees, and were not convertible into cash. This places great pressure on developers to sell lots as quickly as possible after the system has been installed. (Council on Environmental Quality, 1974, p. 77).

Any system of financing has distributional as well as density or land value implications.

The econometric and comparative case study analysis will not be able to test for the complexities of the inter-actions described above. They will, however, attempt to test the linkage and direction of the relationship between land values and sewer policies.

Property Taxation

There is considerable variation in the extent to which the property tax is used among urban areas (Netzer, in Beaton, ed., 1974, p.159). In addition, there are wide disparities within an SMSA on the level and adequacy of the tax base and the level of property taxation. This can lead to what Gaffney (1975) referred to as municipal or fiscal merchantilism, competition for a better tax base. If political units are sufficiently small, the location of particular high property tax income generating business can have a significant effect on municipal finances. The competition for high paying properties can have an effect on the aggregate land conversion process regardless of whether the actic works or not. Indeed, James and Windsor (1976) argue that their research shows that zoning patterns do not relate to the fiscal ideal they established for various types of communities.

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From the point of view of the landowner, the property tax can affect the price of land through the present value (holding costs) and reservation price and, therefore, the supply of land at any given time. If the reservation price exceeds the market price, the owner can hold the land for further gains, though prospects may be uncertain. High property taxes can make it unprofitable to invest in land to hold for appreciation. "It also should be noted that while a property tax increase can lower prices to lot consumers, it may not necessarily reduce the amount of appreciation above farm value. Since, if the property tax rate increase is general, the price of agricultural land could also be expected to fall." (Schmid, 1968). Therefore, the impact of a property tax increase is to reduce the reservation price of land being held for future gains. Lowering tax rates for agricultural land will result in raising present values and reservation prices for fringe land and could be expected to increase landowner gains. The research by Schwartz and Hansen (1975) on preferential taxation supports the analysis that expectations of gains by landowners are greater than the perceived tax benefits of such a policy. Deferred taxation as well as use value taxation also encourage land withholding.

From the point of view of the property tax effect on housing values, it would be expected that high property taxes lower home values and, therefore, site values. The true value of a home includes site value plus construction costs which is a function of operating costs. Therefore, higher property taxes reduce the derived demand for homes but may decrease the costs of development.

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To summarize, high property taxes should increase holding costs of landowners and increase the supply of land for urban uses. The effect on appreciation depends upon the extent to which the high property taxes are applied to agriculture. If there is preferential or deferred taxation for agriculture, while other property taxes increase, then appreciation could become greater.

Operationalizing the relationship between the property tax and site price and appreciation is complicated by variations in assessed values and property tax rates across jurisdictions as well as the high correlation between the average per capita property tax and income, education, and public service variables. However, the variance in the average per capita property tax between cities might also be indicative of the ability of landowners to withhold land. A larger variance might indicate less pressure on landowners because of lower tax rates in the suburbs, assuming that the higher rates are in the central cities.

Nevertheless, other factors cloud the issue still further. For example, income levels are important in calculating the effect of taxes because of the property tax write-offs on the federal income tax. Farmers often pay a proportionately large share of property taxes because of land and other capital intensive investments. When the income of farmers increase, as it did in 1973, 1974, and 1975, their ability to withhold and even buy land increases. Furthermore, the property tax and, indeed, the entire tax structure are related to the population growth rate and the provision of public services in the area.

With this degree of conceptual and operational complexity, the research involving the property tax is exploratory and potential results perhaps directional rather than definitive.

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Summary

This chapter has established the theoretical conceptualization for the relationship between the site price and appreciation measures of economic rent and profit and local government zoning, sewer, and tax policies. It is argued, at the general level, that the degree to which these local government policies restrict the supply of land for certain demanded urban uses will affect the price of the land sold and that part of the appreciation in land value is attributable to monopoly profits.

Specifically, if zoning for large minimum lots is extensive in the land conversion market, the price of smaller lots might be greater because of limited supply. On the other hand, large lots might be considered a differentiated product and sell for a higher price than supply indicates because of potentially inelastic demand. Given that there is likely to be variation in the attitudes of jurisdictions in the same land conversion market, the excess demand for a certain land use limited in one jurisdiction will move to another, less restrictive, jurisdiction which raises the price there. The result of this institutional interdependence is to not only affect the speed and direction of residential location and growth, but, perhaps, keep the relative price differences between jurisdictions essentially unaltered. The degree of variation in policies followed across jurisdictions should also affect relative prices. If supply restricting policies are widespread, prices should be higher than when such policies are rare.

Sewer provision and pricing could be similarly analyzed. Provision of sewered and zoned land for different uses at supply levels

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appropriate to demand results in moderate prices. Over or under-provision of sewerd and zoned land in proportion to demand can result in similar leapfrog land use patterns but different price structures. Restricted sewer supply should lead to higher prices and over-supply of sewers should lead to lower prices.

A complete examination of the property tax is beyond the scope of this research. Property taxation in the land conversion process affects both demand for more services and the ability of landowners to withhold land from the market. Property taxes are quite complex theoretically and empirically, however, the property tax variation across a market will be examined. Zoning, sewer provision and pricing, and taxation have significant interactions which complicate the hypothesis further still.

The unit of analysis of this research is the land conversion market across cities. The fact that this market will generally consist of many local government jurisdictions adds to both the complexity and richness of the model. Previous research has barely investigated the implications of economic and institutional interdependence within the land conversion market. Theoretical and empirical examination of the interdependencies in the land conversion process and the role of local government policies is the essence of this research.

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CHAPTER III

SURVEY AND CRITIQUE OF EMPIRICAL STUDIES OF INTER-URBAN LAND VALUES

Introduction

The determination of urban land values has been studied in a variety of forms: 1) the effects of changes on a particular location over time, 2) comparison of different sites within a city at the same time, 3) comparisons of different locations within a city over time, and 4) inter-urban comparisons of aggregate variables.

Much of the theory used to analyze intra-urban land values is based on von Thünen's model of agricultural land rent. The basic idea is that location rent is determined by transportation cost savings and the concentric zone model of urban land use. Moreover:

Modern economists have inserted the tools of micro-economic theory into this framework and adapted it to an urban setting. In the modern versions, Thünen's town becomes the Central Business District (CBD) of a city; his crops become such urban uses of land as finance, retailing, housing. The object is still to show how competition determines the price of space which is shown to be a declining function of distance from the center. An optimal pattern of land use is determined that is still a sequence of rings, one to each urban use. (Goldstein and Moses, 1973, p.475).

The work of Wingo (1961), Alonzo (1964) and Muth (1971) among others is rooted in the von Thunen model. Their empirical results are weak. The problem with this approach is the changing nature of cities and assumptions which ignore the complexities of the land market.

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Wendt and Goldner (1966), Romanos (1976) and Ottensmann (1975, 1977) raise similar critiques of the von Thünen model based upon the increasing complexity of spatial pulls which have replaced distance from the CBD as the transportation determinant in residential land values. The character of this diversity is discussed by Andrews (1971) who, within the sub-discipline of urban land economics, raises the diverse factors influencing the determinants of residential preferences and the factors developers must consider in location decisions. Those factors include the location of schools, business districts, recreational amenities, etc.

The recent studies which have attempted to explain inter-urban differences in land values by the use of multiple regression techniques have explored FHA data on residential site prices across SMSA's.⁵ Other studies looked at per capita land values or residential site prices across states.⁶ Several other complementary studies examined related factors.⁷ Land value appreciation, one of the approaches

⁵These include Maisel (1963), Mittlebach and Cottingham (1964), Muth (1971), Witte (1975) and Ottensmann (1977).

⁶Keiper, et.al. (1961) estimates per capital land values across states based on the land component of taxable real property. Gottlieb (1965) used FHA data on the average residential price of a site by state.

⁷These include a study by Van Vuuren (1976) on Canadian land values using Spearman rank correlations, a cross-sectional study of housing costs and zoning regulations in New Jersey by Sternlieb and Sagalyn (1973), and a cross-sectional study by Miller (1977) of three Californian cities.

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used in this research was first developed and empirically tested by Schmid (1968). This chapter will consist of both a survey of the analysis behind each aforementioned approach and the econometric methodologies used.

With one exception, previous research efforts have attempted to explain residential site values by SMSA's or states by use of cross-sectional analysis. Witte (1975), however, developed a pooled regression using time series as well as cross-section data. The independent variables used in these studies have varied. These studies will be reviewed then key issues will be summarized to clarify the take off point for the econometric analysis of this study.

Dependent Variables

Geographic Definitions

There are three approaches, based upon the source of the data, for geographically defining the land value variable as well as most of the associated independent variables. First is the research based on State variation done by Keiper, et. al. (1961) and Gottlieb (1965). Keiper et.al.'s data was from the Census of Government. Gottlieb used Federal Housing Administration (FHA) State data. Second, and most common is the Bureau of the Census definition of a Standard Metropolitan Statistical Area (SMSA) used by Maisel (1963), Mittleback and Cottingham (1964), Muth (1971), Witte (1975), and Ottensmann (1977). These articles used the FHA SMSA market price data as the dependent variable. Observations varied from year to year based upon sample size criteria in data collection. Ottensmann also used data provided

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in Schmid (1968) from the National Association of Home Builders (NAHB). This data was an aggregation of local homebuilder associations by metropolitan areas. The exact geographic definitions of the local homebuilder associations are not known but probably correspond most to SMSA's. Schmid's econometric analysis also used the Bureau of the Census definition of urbanized area in conjunction with the NAHB data. Each of these geographic definitions imply different analysis and implications.

The State based studies of Keiper et.al. and Gottlieb used an estimate of the land component of taxable real property on a per capita basis and FHA average price of residential sites in states respectively. Keiper et.al.'s results show a significant relationship between the dependent variable and income, population density and agricultural output variables. Gottlieb was somewhat successful with two income variables and a growth (employment) variable. He, however, found agriculture values insignificant. Keiper et.al.'s research was directed at explaining the geographic distribution of land values. Gottlieb argued that his approach would "yield some valuable insights into functioning of our urban land markets." (1963, p.4) However, while use of State data both for the dependent and independent variables can be useful for analysis of some questions, such as the implications of demographic shifts or State policies affecting land use, the degree of insight into the functioning of urban land markets is limited.

Goldstein and Moses in their "Survey of Urban Economics" noted that "Researchers exhibit an understandable tendency to avoid

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defining the relevant unit of study for their models because of the difficulties of obtaining adequate data." (1973, p.172). Conceptually the land conversion market is that area around a metropolitan area where land is in transition from non-residential use, generally agriculture, to residential or other urban uses. It is defined by those individuals and groups whose function is to convert land to urban uses: developers, landowners, land speculators and public institutions through regulations and policies.

There is a wealth of literature, primarily by demographers and sociologists, which deals with the conceptual and operational problems of defining rural, urban, suburban, rural-urban fringe, and sprawl. (Kurtz and Eicher 1958, Gibbs 1961, Fuguitt 1962, Lieberman 1969, Sinclair and Manderscheid 1974, and Macura 1975). Sinclair and Manderscheid (1974) and Macura (1975) applied different commonly used definitions of rural and urban, respectively, and discovered a large variation in the population which would fall into each category depending upon the definition applied. Of course the land conversion market is in transition. What is fringe today is most often city or suburbs in the near future. So while the concepts of fringe and land conversion market don't necessarily overlap, the problems associated with each are similar.

Research in the area of land conversion has one of the common difficulties in working in the transition area: "Frequently the theoretical and the empirical categories have been at variance since

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the former tends to focus on general social characteristics whereas the latter usually emphasizes physical, geographical, demographic, or political attributes" (Kurtz and Eicher, 1958, p.32).

The conceptual definition of fringe which seems appropriate for this research focuses on land characteristics.

Land use in the fringe is of a unique nature which distinguishes the area from all other residence categories. This unique characteristic is the existence of mixed rural and urban land use--much of the area is still in farmland and residence of non farm dwellers are interspersed among the farms. This mixture of land use exhibits no consistent pattern of farm and non farm residences; if a consistent pattern of residences exists, i.e., if there are solid groups of residential homes without interspersed non-farm dwellings, this area is not considered fringe area. (Kurtz and Eicher, 1958, p.35).

It is difficult, however, to find data based on this kind of definition.

The land conversion market can take on various forms. It can be a narrow fringe or a broad belt. Also, "long ribbons of what is essentially urban development, both as regards the form of buildings and the functions performed in them, extend far out into the rural areas along the main highways." (Shryock, Siegel, and Associates, 1971, p.162). Another example is marked leapfrogging to the extent that some discontinuities occur in residential patterns. Harvey and Clark (1965) defined three spatial patterns commonly associated with urban sprawl: 1) low density continuous development, 2) ribbon development, and 3) leapfrog development. These can be considered descriptive categories in a static sense. They may all be occurring in any particular metropolitan area but will change over time.

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The definition of the unit chosen to express some relationship, i.e. population density, will influence the results of the research. One could have population dispersed throughout the area or concentrated at a particular point in the area and get the same average density depending upon the grid chosen.

Research into land use patterns must address empirical problems of defining the density of urban development. Gross and net density are both of interest. Gross density, as used here, is the ratio of the metropolitan area to the total population. This approach has some potential in picking up leapfrog and ribbon development by including all land uses, though the variation in land used for non-residential development will exacerbate problems in analysis. Net density, the ratio of land for residential uses to people, might be able to pick up low density continuous development though here again the distribution of residential mixes from one metropolitan area to another will vary. The grid or grain chosen for analysis has direct impact upon the analysis. For example, one would have to have a grid capable of showing ribbon development in order to examine hypotheses associated with ribbon development. Other grids would be needed for other characteristics of concern.

While it can be argued that low density continuous development and ribbon development might explain higher land values, land values for sites transacted over a large grid will, in the case of leapfrog development, include the expensive closein land transactions and the less expensive, more distant transactions. Therefore the data might inadvertently indicate that appreciation is lower with leapfrog development.

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One way of capturing some of the variation in settlement patterns is to know the gross amount of vacant land in a metropolitan area. Northam (1971) and Niedercorn and Hearle (1968) surveyed the land uses, particularly vacant land, for various American cities. Both reports point to the proportion of vacant land being greater for lower population size cities. While the numbers generated provide insight on the past development patterns, and could indicate if presently vacant land is filled in later, it seems unlikely that either study rigorously defined the geographic area to which the questions were directed. Therefore, significant variations based on newness and size of the cities could exist.

Previous research has also found a statistically significant and positive relationship between site price and gross population density. More intensive use could indicate greater competition for land hence greater appreciation. On the other hand, higher appreciation or site price will decrease the quantity demanded and raise density. This suggests a simultaneous relationship. Income and preferences also enter into this interaction. The implications of density and spatial patterns on the issue of the cost of public services will be dealt with later when discussing sewer provision and taxation.

Idle or vacant land on the fringe remains difficult to measure but remains a concern in land value analysis as Clawson noted:

...land within the suburban zone not actually used for urban purposes typically is not used at all. Our best estimate is that there is about as much idle land in and around cities as there is land used for urban purposes. In the suburbs the idled land is an even larger proportion. (1971, p.318).

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If this idled land is held for speculative purposes, the level of expectations and uncertainty associated with particular markets is of interest. Ottenmann's (1977) model associated expectations with percent of change in population. Schmid (1968) and Hansen and Schwartz (1975), however, indicated the possibility of expectations exceeding actual gains.

Another aspect of operationalizing the land conversion market concept also presents a dilemma. On one hand one can use the Census definition of urbanized area. The basic concept is a population density index. However, according to another Census publication, "If the suburbs are viewed as a peripheral part of the physical city, and therefore entirely urban, rather than as a traditional zone between urban and rural territory, then the former (urban fringe), more restrictive definition would be the preferable one." (Shyrock, Siegel, and Associates, 1975, p.130). Other census definitions such as Standard Metropolitan Statistical Areas (SMSA's) are also problematic conceptually because of their basis on political units. Unfortunately urbanized areas and SMSA's are the basis of most of the available data for cross city comparisons and so serve as the basis of measurement in the econometric model. Much relevant area information is lost; e.g. areas showing potential for population growth and increasing density ratios and areas showing marked leapfrogging of residential or commercial development will not be captured by these measures.

On the other hand, within the comparative case study research, alternate systems for operationalizing the heterogeneous features of the land conversion market will be examined. Comparison of these

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detailed approaches when compared to the exigencies of the secondary data used in the econometric model should provide insights on the validity of this and earlier research. It is clear, however, that the method selected for operationalizing the land conversion market is critical to the definition of all variables and formation of all hypotheses. It is necessary, nevertheless, to be somewhat arbitrary and pragmatic in the choices made.

The geographic problem with most of the previous efforts at explaining residential site or raw land values is the failure to indicate the problems associated with data using any particular geographic definition. As with these earlier efforts, this study will be using SMSA and urbanized area data but will interpret the resultant information in the context of operational difficulties in the geographic base of the definition.

Comparison of Dependent Variables

There have been four types of dependent variables used in the studies being reviewed here. They are: 1) the land component of property value, 2) the price paid for raw land by developers, 3) the price of residential sites either received by developers (NAHB) or assessed by the FHA, and 4) land value appreciation which is calculated using raw land price or site price. Table 2 summarizes previous research.

The estimate of the land component of taxable real property assessment ratios used by Keiper, et.al.'s (1961) study from the Census of Government for 1957 was highly correlated with total real property value. "The Spearman coefficient of correlation between land and property rankings in 1956 is .96" (p.157). Moreover, the regression

Adm. et. al. (1961) ²	
Per acre land value	
to land based on an	
estimate of the land	
market value	
and property tax (1961)	.73

Adm. (1961) ²	
Per acre of	
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to 1961's	.46

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market value	
and property tax (1961)	.27

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and property tax (1961)	.22

Adm. (1961) ²	
Per acre of	
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to 1961's	
and property tax (1961)	.41

TABLE 2
SUMMARY OF EMPIRICAL MODELS OF PREVIOUS RESEARCH

Y/YEAR/ INDEPT VARIABLE	R ²	INDEPENDENT VARIABLES BY VARIABLE TYPE AND STATISTICAL SIGNIFICANCE WHEN AVAILABLE (t values in parenthesis, standard error otherwise)					
		Income	Population Density	Total Population	Population Change	Agricultural Value	Other
et. et. al. (1961) ¹ capita land value rates (based on an acre of the land onset of taxable property for 1956)	.75	Per Capita Personal Income by State .51	Population Density by State .79			Value of Agricultural Output by State .64	
al (1963) ² Price of dug sites MSA's	.46		Population Density, MSA, 1960 .40 (4.31)	Change in Population (2) 1950-1960 By SMSA .22 (1.98)	Value of Agricultural Land in State .29 (2.67)	FMA Price of New House, SMSA .36 (4.27)	
Isach and ingham (1964) Mean Price of dential Site	.27	Average Income per Household, SMSA, 1960 .23 (1.17)		Total Population SMSA, 1960 .13 (.68)		Highest Land Value on SMSA 2.10 (2.52)	
lieb (1965) ⁴ Mean Price of dential Site by se, 1961	.22	Mean Annual Per Capita Income by State, 1961 .23 (significant)		Growth in Nonagricultural Employment, 1960 Land by State -15 (insignificant)	Value of Agricultural Land by State 1960 .03 (insignificant)	Supply of Vacant Lots -07 (insignificant)	Degree of Favorable Assessment of Vacant Land -10 (insignificant)
		Percent of Population With Income Above \$10,000 by State, 1961 .44 (moderately significant)					
is (1966) ⁵ Apprecia- of Raw Land Above Values ite, HANB,	.41	Median Family Income (\$) 1960 Urbanized Area .129 .92	Population Per Square Mile Urbanized Area, 1960 .234 .214	Total Population Urbanized Area, 1960 -.001 .00	Percent Change in Population 1950-1960 Urbanized Area -.493 .87	Percent Population Living in SMSA Along That Work in City 1960 SMSA -7.029 .30	Land Area Urbanized Area, 1960 5.044 .001
		Median Family Income 1960 (\$) City .013 .71		Total Population City, 1960 -.001 .04	Percent Change in Population 1950-1960 City 18.857 .00		Percent Change in Land Area 1950- 1960 Urbanized Area -.932 .51
				Percent Population Living in Prings, 1960 3.369 .60			

Table 2 cont'd.

Nich (1971)⁵
Log of the Average
Price of Resi-
dential Sites in
SMSA's, 1966 .76

Vitte (1975)⁶
Natural Log
of the Price
Per Square
Foot of
Residential
Sites Across
SMSA's
1969 .8

Vitte (1975) Pooled
Regression of
Natural Log of the
Price Per Square
Foot of Residential
Sites Across SMSA's
1966-1969

Ottomann⁷
(1977)
1978 Raw Land
Price, 1964

Sources: Some of the information
All information from

- ¹Other statistics were not used.
- ²These t-values assume that
Vitte (1975, p. 362).
- ³Gottlieb did not report Σ -
of his regression analyses.
- ⁴Schmid's results report are
- ⁵Nich used the log of all
Vitte (1975, p. 362).
- ⁶Vitte (1975, p. 357) reports
a complete definition of W.
- ⁷Ottomann (1977) reports

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(1971) ⁵ the Average of Best- ial Sites in 1966	Net Family Income 1960 (1.51)	Population Density, SMSA 1970 (3.12)	Percentage Change in Population 1960-1970 SMSA .18 (1.89)	Average Value Per Acre of Agricultural Land in State .19 (3.11)	Average Site Size -.49 (8.21)	Mortgage Interest Rate -.11 (1.40)	Construction Cost Index 1960 (.62)
(1975) ⁶ il Log Price Source if ential Across	Median Income of Mortgage of FHA Loans SMSA .27 (4.72)	Population Density, SMSA 1970 (3.12)	Percentage Change in Population 1960-1970 SMSA .18 (1.89)	Average Value Per Acre of Agricultural Land in State .19 (3.11)	Average Site Size -.49 (8.21)	Mortgage Interest Rate -.11 (1.40)	Construction Cost Index 1960 (.62)
	Unemployment Rate, SMSA, 1970 .09 (1.38)		Percentage Change in Nonwhite Population 1960-1970 .05 (.70)		Housing Age .03 (.31)	Average Loan to Price Ratio -.09 (1.18)	Average Term to Maturity .07 (.93)
(1975) Pooled ation of al Log of the Per Source of Residential Across SMSA's 1969	Median Income of Mortgage of FHA Loans SMSA .38 (11.78)	Population Density, SMSA 1970 (3.12)	Percentage Change in Population 1960-1970 SMSA .13 (5.18)	Average Value Per Acre of Agricultural Land in State .27 (10.94)	Average Site Size -.49 (20.15)	Dummy 1967 -.49 (20.15)	Dummy 1968 -.49 (20.15)
Mean) Raw Land , 1964	Mean Family Income, 1960 SMSA .43 .45	Total Population 1960, SMSA 1.32 .24	Percent Change in Population SMSA 1950-1960 47.71 12.81				

5: Some of the information on other studies in this table came from Witte (1973). Other results appeared in Schmidt (1968) and Ottensmeyer (1977).
All information from Witte (1973), Table 3, were checked against the original source. Several footnotes below were also from Witte.

6: Statistics were not reported.

7: t-values assume that the figures in parentheses below the regression results in Mittlebach and Cottingham are standard deviations of b 's.^a
8: Witte (1975, p. 362).

9: Witte did not report t-statistics so it was necessary to obtain a notion of significance of various variables from his discussion of the results in regression analyses.^a Witte (1975, p. 362).

10: Witte's results report standard errors and are thus not in parentheses.

11: I used the log of all variables in his regression analyses. Witte's coefficients are estimated using unmanipulated not standardized variables.^a
12: Witte (1975, p. 362).

13: Witte (1975, p. 337) reported a series of cross-sectional regressions for years 1964-1969. The generalized equation for 1969 is presented here.
14: Complete definition of Witte's variables appear in Appendix A, supplied upon request.

15: Ottensmeyer (1977) reports standard errors. Best results reported.

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model worked better for total property values (per capita) than the land component estimate. To Keiper et.al. the most troublesome issue arose from not only the lack of consistency of assessment practice between states, but also within states, hence, offsetting effects of different land market practices.

The best data operationally for site price or appreciation are the price paid for raw land by residential developers. While this data may exist in scattered studies, only the NAHB data for 1960 and 1964 represents significant systematic gathering of such data. This data are reproduced in Schmid (1968) from NAHB sources.

Residential site prices as reported by FHA and NAHB has several internal components: 1) development cost of a site, 2) agricultural opportunity cost (e.g., agricultural value), and 3) size of the site. Each of these factors imply different policy questions. They in turn can explain the reason for statistical significance found in such independent variables as the construction cost index (Muth, 1971), average site size (Witte, 1975) and value of agricultural land or products (Keiper, et.al., 1961; Maisel, 1963; Witte, 1975).

Schmid's land value appreciation is derived from site value. The computation process is as follows: For each city the analysis begins with the price per finished lot. The farm value of the land in the lot is computed and added to the lot improvement costs, and the total is subtracted from the finished lot price, to obtain the amount of absolute appreciation. The appreciation is then expressed as a percentage of the farm value.

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Ottensmann, in commenting on Schmid's appreciation variable

notes that:

Schmid's dependent variable has percent appreciation over farm land values. This is highly correlated with land prices themselves, since farm land prices are much smaller and vary less. However, any error in the farm land price data is magnified by this procedure, producing large variations in the appreciation variable. (1977, p.394).

This argument notes the measurement difficulty but does not directly challenge the underlying theoretical concept.

Independent Variables and Regression Results of Previous Research

The following results of previous econometric research stand out:

- 1) Income and population density were most often found significant.
- 2) Total population and population growth were often found significant when either income or density were found insignificant or not used.
- 3) Value of agricultural land or output was found significant in three out of four studies explaining state or SMSA site variation.
- 4) Other variables found significant in various studies related to site size, construction cost (indices) or price of complements.

Income and population seem to have an inter-relationship which has affected which variables have been found significant in these studies. Average income of one sort or another was significant in all but two studies (Maisel, 1963; Schmid, 1968). In both of those cases population change was found significant. Also, in only one case out of four (Witte, 1975) did population density enter the equation with income. In other words, income seems closely associated with size variables, total population or gross population density. As the

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population (size) of the metropolitan area is larger, then income per family should be greater. The relationship between density and income is complex. Higher income is associated with a greater ability to purchase larger lots but the cost of living in dense areas and the costs of congestion are also associated with greater incomes. This, of course, leads back to the problem of geographical definitions and the problems of mixing different characteristics in any of the three major geographic definitions and even within the fringe area of the urbanized area. Income may also indicate a degree of market power on the part of sellers, either direct or through expectations, to charge what the buyer can pay or inversely a measure of the degree of willingness of buyers to pay.

Percent change in population is statistically significant in four studies. This also perhaps indicates some role for expectations. Value of agricultural output or land appeared significant in three studies and insignificant in one other. This demonstrates the importance of agricultural land value as an indication of opportunity cost or competing uses of land and, hence, a supply characteristic.

The other variables were residential costs, site size and price of new homes. Construction costs could affect both supply and demand. Assuming some relationship between construction costs and development costs, the supply of lots will be affected. On the other hand, construction costs associated with the price of new homes will also affect demand. Site size was found significant by Witte (1975) and indicates a relationship between per unit prices and size of the lot.

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Issues of Functional Form in the
Dependent and Independent Variables

The issue of functional form was raised initially in a footnote by Witte: "The logarithm rather than the unmanipulated value of the price per square foot was used in order to give the dependent variable a more nearly normal distribution." (1975, p. 357). On the other hand, Witte stated that, "Muth used the log of all variables in his regression analysis. Muth's coefficients are estimated using unmanipulated not standardized variables." (1975, p.362).

The issue of functional form is related to the hypothesized relation between a dependent and independent variable. In any given situation the researcher cannot know with complete certainty the nature of the functional relationship. "Ideally, his theory tells him unambiguously which to choose; if he fails to utilize the appropriate one in this situation, his estimates will be biased and/or inefficient. Only if complete searching of the theory does not give the researcher any direction should he proceed to use the following ad hoc procedure, which can never completely substitute for a good theory" (Rao and Miller, 1971, p.105). Certainly in comparing the research to date there has been little theory and no clear evidence that log forms are superior to linear forms of the equation. The practice of Witte and Muth seems to have been to use non-linear functional forms to take care of concerns about heteroskedasticity without concern for the theoretical implications of these functional forms.

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Comparison of Studies by Witte and Ottensmann

The two most recently published studies, by Witte (1975)(1977) and Ottensmann (1977), can be contrasted to raise several issues. These two studies represent a contrast in several areas of approach to research in this area. These include 1) number of variables considered, 2) functional form, 3) regression techniques tried (e.g. Ottensmann used a recursive model and attempted some simultaneous equations while Witte had a series of cross-sectional models and a pooled regression), 4) theoretical arguments, and 5) results. In reference to Witte's article Ottensmann raised the following issue to be considered here.

Other alternative explanations of the level of land values have been provided; however, the derived demand model developed and tested by Witte (1975) is one of the best examples. She has achieved higher coefficients of determination but only at the expense of considering a greater number of independent variables. The simple straightforward model tested here, with but three independent variables, must be considered as a valid alternative. (1977, p.389).

Ottensmann's three independent variable model offers very little new including the theory justifying their use. On the other hand, Witte presents little rationale for the use of variables or for the sometimes fanciful proxies chosen. While this may have been a function of publication space it also seems that little attention was paid to the implications of each specification. Regarding variable selection Witte noted.

In many cases, a number of alternative measures of the determinants of residential site prices were found and that measure which gave the best explanation as measured by the adjusted coefficient of determination was the one utilized. (1975, p.356)

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The results of both studies, however, are not reassuring for the development of instrumental variables designed to influence the land conversion market. As do earlier efforts they do point to income, population growth, size and population density as significant variables. These alert us to the need to study in more depth the applications of urban shape and structure. We have on one hand a simple model capable of multiple explanations or vague generalities and on the other hand a finely manipulated model with little theory beyond the concept of derived demand.

Ottensmann experimented with a log functional form and found little improvement in results. "Different functional forms were used in regressions for some of the variables. For example, a logarithmic transformation of the population variable was tested in all of the regressions. None of the tests were conclusive." (1975, p.395). Witte used a log form of the dependent variable in an attempt to achieve a more nearly normal distribution.

The regression techniques tried by each of these studies also need comment. Ottensmann, while reporting cross-sectional results of a recursive model using OLS also attempted a system of simultaneous equations. He reported:

Two-stage least-squares procedures were used to estimate the parameters, with population, income and the population change variables considered as exogenous. In each case, the parameter values associated with the original three predictors of land prices were hardly changed from those obtained with the recursive model, while the parameter associated with density of development was insignificant. (p.395)

Witte used standard multiple regression techniques. Given the number of variables used by each it seems that the techniques used

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were appropriate to the other model. For example, two-stage least squares methods raise issues of a critical nature when variables are left out of the model. Witte, however, failed to take advantage of the large number of variables used for either a recursive or simultaneously determined model. There are, of course, advantages and disadvantages of each approach but theory clearly indicates that some variables have simultaneously determined characteristics.

Elasticity Issues Raised by Witte

In another article using the same data base, Witte (1977) reviewed the elasticity assumptions of previous research, then developed an estimate of the price elasticity of demand and tested earlier assumptions of the constant elasticity of demand. The results indicated a high elasticity of residential site price with respect to income, particularly for middle income groups. In addition, the following results were noted.

Our findings indicate that the elasticity of residential site price with respect to size is highest for SMSA's with medium-sized lots (approx. $\frac{1}{4}$ acre), and much lower, indeed highly negative, for SMSA's with both small and large lots. If, as hypothesized above, this is due to large lot zoning and other local government policies, it would seem possible to lower site prices by appropriate alteration of these policies. Perhaps the most promising of such alterations would be restrictions on large-lot zoning and encouragement of the redesign of older subdivisions.

The relatively low estimate obtained for the price elasticity of demand for residential sites (-.7) provides a potential explanation for the prevalence of land withholding, particularly in rapidly growing areas. Assuming that holding vacant land is profitable, as it normally would be in a rapidly growing area, this inelasticity of demand would encourage land withholding since this would increase the capital gains of the land holder. Such land withholding could be made less

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profitable if land holding costs were increased. Local governments could increase land holding costs by either increasing the tax rate on vacant land or raising the assessment on such land. (Witte, 1977, pg. 408-409).

The conclusions drawn by Witte regarding the elasticity of demand for certain land uses are supportive of the elasticity assumptions made in Chapter II. Zoning and property tax conclusions drawn are, however, not sufficient to handle the actual complexity and interaction of local government policies in a metropolitan area.

Summary

Previous research has concentrated on demand variables such as total population, median family income, percent change in population, etc., to explain a range of variables related to site price and/or appreciation. Variation in the unit of analysis and problems which arise from these difficulties were reviewed. In both the selection of explanatory demand variables and units of analysis, the final choice is arbitrary. Because of the complexity of the urban structure many aspects of community characteristics are interdependent with other characteristics. While each listed variable is indicative of different trends of interest, selection of the appropriate group of variables can only be made after an analysis of the specific theoretical model to be tested. Geographical units are less amenable to such decisions and the selection of which unit is used often depends on the available data. However, where possible this research uses the Census urbanized area as most appropriate to capturing the land conversion market related characteristics.

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Findings in earlier research function as a base for the chapter to follow. While emphasis in this research is on development or the potential for development of instrumental variables related to local government policies, earlier models provided much direction in variable selection and empirical problem identification. The next chapter develops the data and measurement for site price and appreciation, essentially updating ideas developed by Schmid (1968).

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CHAPTER IV

SITE PRICE AND APPRECIATION

Introduction

This chapter discusses and operationalizes the dependent variables, site price and appreciation. Site prices are discussed initially. The issues related to the Federal Housing Administration (FHA) and National Association of Home Builders (NAHB) data sources are then raised. The various components needed to calculate appreciation are then sequentially discussed. These components include site size, development costs, and agricultural opportunity costs. The calculation of appreciation is then demonstrated. This chapter concludes with a brief summary of the land conversion process and its relationship to site price and appreciation.

Site Prices

Introduction

Ideally, the price paid for land to be converted to urban (residential) uses should be used as a base for calculating appreciation or used on its own merits. However, data on the price paid for raw land is nearly nonexistent. Clawson and Stewart (1966), among others, has dealt extensively with the woes of analysis brought about by this scarcity. Market price of a site, or site price, price of a site as a percentage of total house and land value, and average value of house and site, along with value of land and buildings in

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agriculture are reported for the U.S. from 1960 to 1977 in Table 3. With the exception of agricultural land value, which comes from the Census of Agriculture, the data came from the Federal Housing Administration Data on Cities and States.

As Table 3 shows, the mean market price of a site increased over 300 percent from 1960 to 1976. Similar increases were noted for 1948 to 1964 by Schmid (1968, p.7). While the site value as a percentage of house value remained near nineteen percent in 1976, as it was in 1964, it still represents a jump from the eleven percent of 1948. The high of twenty one percent in 1972 preceded the rapid rise in the cost of a house, as indicated by the average property value increase of eighty four percent from 1972 to 1976 for moderate to low priced FHA insured homes.

Price of a residential site has been used as a proxy for raw land value. Problems arise because other sub-components, such as development costs, of the site price have different characteristics and policy implications than raw land. Variations across cities and over time can be explained by agricultural values, lot size and quality, development costs or land value appreciation. If the variation is due to agricultural values, the implication is that agricultural opportunity costs are high and more land is withheld from the market. If the higher prices are a result of lot size and quality, then larger and better lots are being demanded and purchased. If development costs have increased, then the source of those increases, whether private or public, should be examined. However, if appreciation has increased, then the sources should be isolated and examined. While

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TABLE 3

SITE PRICE AND RELATED STATISTICS, 1969-1977

Year	Market Price of a site (\$per site)	Mean Price of house and site (\$)	Price of site as percent of property value	Value of land and buildings in agri- culture (\$per acre)
1960	2223	14326	15.5	116
61	2477	14855	16.7	118
62	2725	15460	17.6	124
63	2978	16189	18.4	130
64	3130	16522	18.9	138
65	3416	17289	19.8	146
66	3544	18099	19.6	158
67	3776	19163	19.7	168
68	4161	20116	20.7	179
69	4214	21186	19.9	188
70	4961	23710	20.9	195
71	5066	24373	20.8	203
72	5307	24321	21.0	219
73	5051	25112	20.1	247
74	5372	28488	18.9	310
75	6329	33376	18.5	343
76	6963	35600	19.1	390
77	n.a.	n.a.	n.a.	456

Source: FHA Data on Cities and States, 1960-1976; U.S. Department of Agriculture, Economic Research Service, Farm Real Estate Historical Series Data: 1850-1970, ERS 520, Washington, D.C. June 1973.

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these four causes of increased site values are examined, the theory and interest of the research in this thesis is on appreciation. Empirically examining both site price and appreciation will clarify the relationship between the two.

Data Sources

The Federal Housing Administration Data for Cities and States has published site price data for selected housing areas defined as Standard Metropolitan Statistical Areas since 1948. The National Association of Home Builders has also published data for site prices for 1960, 1964, and 1969 and raw land prices for 1960 and 1964. Each of these data sources, for the following empirical research, will be discussed below.

As mentioned, the FHA reported site price data for selected metropolitan areas. These metropolitan areas varied from year to year depending upon sample size. It's likely, therefore, that the FHA sample is biased towards active, growing areas and/or larger areas. This selection process also severely limits the sample size for longitudinal studies and is likely to increase the aforementioned bias over simple cross-sectional analysis. Other aspects of the FHA data are succinctly discussed in an appendix supplied by Witte (1975):

The ideal dependent variable for the testing of the model developed in this paper would be the average price of single family building lots in well defined housing market areas for sites of standard size, quality and location. The actual dependent variable used in this model is only standardized for size and is for somewhat well defined market areas. It is not the average price for all building sites but rather the price for a 70 to 100 percent sample of new homes insured by the FHA, under 203(b). Sampling errors can be considered minimal due to the large percent of population samples; however, the FHA tends to

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insure middle or moderate income housing and hence their figures for site prices may not be representative of the upper or lower portions of the housing market. In addition, the lagged adjustment of FHA mortgage ceilings probably means that FHA site prices understate rates of change of site prices in periods of inflation. The new homes which the FHA insures are primarily located in the newly developed tracts lying in the suburban parts of each SMSA. However, since the land built on in each year and in each SMSA will not have the same locational dispersion, an unknown bias is introduced into inter-temporal or cross-sectional comparisons. In addition, the share of housing loans, insured by the FHA, in each market varies from year to year and from SMSA to SMSA and hence the degree to which average FHA site prices represent the true average site prices for an SMSA in a given year will vary. A major advantage of FHA data is that the value of the site is estimated by trained appraisers in order to make important loan decisions. (Appendix A)

As noted in Chapter III, the FHA is the prime source of data in this research area. However, Schmid (1968), and later Ottensmann (1975) using Schmid's monograph, used data from homebuilder surveys of the NAHB. The geographical definition of the survey was based on local homebuilder organizations but it could be expected that the NAHB data is probably closer to the SMSA political delineation rather than the urbanized area or land conversion market. Responses from the large membership surveys involve an unknown bias on non-membership and non-response as well as possible regional variation in responses. The NAHB data also picks up a wider spectrum of the housing and land market. Since NAHB site size and value data is consistently larger than FHA data, the NAHB data probably reports more higher valued residential development than it does the lower valued part of the spectrum. NAHB data, as FHA data, will reflect land substantially outside of the land market of interest. Nevertheless, for the available years, the existence of both FHA and NAHB sources provide a useful contrast and complement to each other.

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Residential site size has been decreasing steadily since 1966. The low period was registered during the 1974 recession as demonstrated in Table 4.

TABLE 4

AVERAGE SIZE OF LOT, SINGLE FAMILY, FHA 1966-1977, U.S.
HIGH AVERAGE STATE AND LOW AVERAGE STATE, 1966-1977

Year	Average Size of Lot U.S. (sq. feet)	High Average State (sq.ft.)	Low Average State (sq.ft.)
1967	9,796	22,526 (Conn.)	6,930 (Cal.)
1968	9,186	22,633 (Vt.)	6,788 (Hawaii)
1969	9,580	17,215 (Miss.)	6,325 (Nev.)
1970	8,611	16,587 (S.C.)	6,336 (Cal.)
1971	8,558	17,090 (S.C.)	5,973 (Cal.)
1972	7,731	14,770 (Ala.)	5,515 (Cal.)
1973	7,502	14,476 (S.C.)	5,676 (Penn.)
1974	7,456	15,239 (S.C.)	4,251 (N.J.)
1975	7,972	15,556 (Ala.)	2,395 (Md.)
1976	7,983	16,470 (S.C.)	6,508 (Cal.)

Source: FHA Data for Cities and States 1967-1976.

National Association of Home Builders data in Table 5 demonstrated that at least through 1969, the average size of a finished lot had been increasing.

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TABLE 5

AVERAGE SQUARE FEET OF FINISHED LOT, NAHB

<u>Year</u>	<u>Sq. Feet</u>
1950	7558
1960	8932
1965	10312
1969	12839

Source: Sumicrast and Frankel (1970, p.58).

While it could be expected that the NAHB lots are for more expensive housing trends since 1969 should be expected to parallel FHA trends; unless restrictions, such as large lot zoning, restrict supply. Nevertheless, the data indicate that as the price of a site has risen over time the size has decreased. This does not speak to the quality of the sites and the development costs of a site.

Operationally, in the case of the NAHB series, the figure of 2.6 lots per acre developed by Schmid (1968) is used. For the FHA data, site size by metropolitan area has existed since 1966. These respective figures are used to calculate agricultural opportunity cost per site.

Development Costs

Both in the literature and in discussions with developers the rapid rise in the costs of improving a lot for urban use has been regarded as an important reason for the increase in the market price of a site. Government regulations are often blamed for much of the increase on these costs. A detailed analysis of this issue is beyond the scope of this research. However, because of the importance of

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development costs to the calculation of land value appreciation, some of the issues will be sketched and some data reviewed.

Sagalyn and Sternlieb (1973) concluded that, "The impact of subdivision improvements, given the present uniformity of a high level of standards, does not appear to be statistically significant in explaining selling price variation." (p.56) Their study was for communities in the state of New Jersey. This might indicate strong state or even regional consistency of requirements and costs associated with subdivision development costs. National Association of Home Builder data does indicate strong regional variations. Skepticism about that data arises because of the suspicion that intra-regional variations (say between California, Oregon, and Washington) can be as significant as inter-regional variations. However, neither national nor cross-city data exists which can improve on the available data, primarily from the NAHB.

Nevertheless, data available for the city of Detroit allows some perspective on the increase of development costs over time.

Table 6⁸ of estimated subdivision development costs demonstrates the rapid rise in development costs from 1963 to 1976 of a total of

⁸ Table 6 summarizes data from Appendix B prepared primarily by Robert H. Carey, President, Thompson-Brown Company, with the exceptions of 1958, 1959 by Ross Campbell and 1975, 1976 by Roy Russell, both associated with Thompson-Brown. While there are some difficulties with the data base because of changes in definitions and a few apparent inaccuracies, this time series seems quite unique. The data were calculated for each year and does not involve retrospective calculations. The articles for which the data was prepared appeared in a number of publications including the Michigan Builder. Furthermore, for the years 1969-1974 the articles written by Mr. Carey included sewer and water use and tap fees for selected municipalities in the Detroit metropolitan area and are reproduced in Appendix A.

TABLE 6

ESTIMATED MINING-FIELD DEVELOPMENT COSTS (DOLLARS)
1953 AND 1955-1956
FOR LOT 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000

Year	63	64	65	66	67	68	69	70	71	72	73	74	75	76	Percent change 53-76	Percent change 70-76	Percent of total 1953	Percent of total 1956
Power System	815.	821.	821.	952.	1095.	861.	1175.	1175.	1293.	1395.	1439.	1500.	1586.	1665.	106.	82.	19.7	10.6
Water System	550.	550.	550.	616.	698.	795.	779.	779.	862.	879.	899.	999.	1039.	1091.	90.	50.	13.3	6.9
Roads and Bridges	505.	505.	505.	1110.	1225.	1310.	1260.	1050.	2037.	2118.	2255.	2622.	3233.	3991.	407.	80.	10.1	22.3
Land Balance	200.	200.	200.	220.	269.	290.	313.	313.	375.	401.	437.	500.	555.	611.	206.	95.	4.8	3.9
Exploring and Inspection	215.	215.	215.	286.	286.	376.	439.	400.	591.	591.	701.	910.	1006.	1097.	410.	125.	5.2	7.0
Plant and Construction	375.	406.	406.	477.	530.	569.	660.	690.	757.	799.	856.	990.	1116.	1353.	300.	98.	7.8	0.6
Cost of Water, Electric, Gas, and Fuel	1030.	1376.	1376.	1760.	1913.	1890.	3822.	3908.	4211.	4390.	4036.	9622.	5908.	6308.	339.	62.	9.8	0.4
Total	4125.	4690.	4690.	5931.	6639.	6308.	8995.	9409.	10916.	10955.	11390.	13093.	14663.	15622.	277.	71.	99.7	99.7

Source: Prepared originally by Robert H. Gray, President, Thompson-Rumsey Company, Detroit, Michigan. This table is a summary of data in Appendix B.

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279 percent. Sewer system and water system costs rose 104 and 98 percent respectively. This was a slower rise than in other costs and indicates a drop from 19.7 to 10.6 and 13.3 to 6.9 respectively in the proportion of those services to total development costs. This could indicate that the source of increased costs via government requirements are in road and drainage. Further evidence of a limited role for costs associated with sewer and water regulation is drawn from the Appendix A of sewer and water charges and fees. From 1969 to 1974 sewer system and water system development costs increased by 41 and 37 percent respectively while sewer charges and water charges rose by 22 and 17 percent respectively. This could indicate that the user charge aspect of government regulations were not rising any faster and even much less than other factors associated with development costs.

A recent report by the General Accounting Office (1978) indicated, however, that, "In the 87 communities sampled, we estimated typical savings of about \$1,300 a house if communities would allow 17 less expensive requirements for streets, sidewalks, driveways, and water and sewer systems." (p.15) That report details the components in terms of street width, number of inches of concrete deep, etc. and noted the large variation in requirements for its sample size. While no breakdown was available by community, a few hints of regional and intra-regional variations in municipal development, utility and building fees are presented in Table 7.

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TABLE 7

SELECTED MUNICIPAL DEVELOPMENT, UTILITY AND BUILDING FEE
RANGES, AND AVERAGE FEES FOR ASSOCIATED SMSA, 1978

Census Region and Selected SMSA	Range of Development, Utility and Building Fees for Selected Communities (\$)	Average Develop- ment, Utility and Building Fees for Associated SMSA(\$)
Northeast		
Philadelphia	307-1495	1025
Nassau/Suffolk	526-2485	973
North Central		
Chicago	200-1293	775
St. Louis	73-1302	841
Cleveland	192-1144	639
South		
Houston	56-1048	543
Atlanta	293-909	564
Washington, D.C.	1476-3265	2398
West		
Los Angeles/Long Beach	1003-2274	1418
Seattle/Everett	434-1949	842
Denver/Boulder	1402-3172	2275

Source: General Accounting Office (1978, p.27).

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The data on and empirical research into development costs and the impact of government regulation are sparse. The need for research seems great although conclusions seem to be drawn and normative interpretations implicit.

Site development costs have been one of the most steadily increasing components of housing costs generally over the past ten years. This has happened because higher, more costly standards have evolved and because costs formerly the responsibility of local government and not included in the purchase price of housing have now been shifted to the developer, who passes them on to the housing consumer. Site development may include the costs of grading and clearing; construction of on-site or off-site utilities (water, sewer, gas and electricity); storm water management; dedication of land for on-site community facilities, such as schools and parks; payments in lieu of dedication; and various fees, charges, and other assessments. (HUD, 1978, p.23).

Table 8 summarizes the development costs estimates used to calculate appreciation. It provides regional data for development costs per front foot multiplied by the national mean lot frontage to get development costs per lot by region. This regional number is then used to calculate appreciation for metropolitan areas which are located primarily in a state associated with the defined regions. The difference in the national average site size between the NAHB and FHA sites in 1969, the FHA was .72 of NAHB, was used to calculate the development cost for an FHA site.

Agricultural Opportunity Costs

It is argued in this research that the market value of agricultural land for agricultural use represents the opportunity cost of the land. This section will briefly review major factors operating in the rural land market, factors which affect the ability of the landowners, speculators or farmers, to hold land.

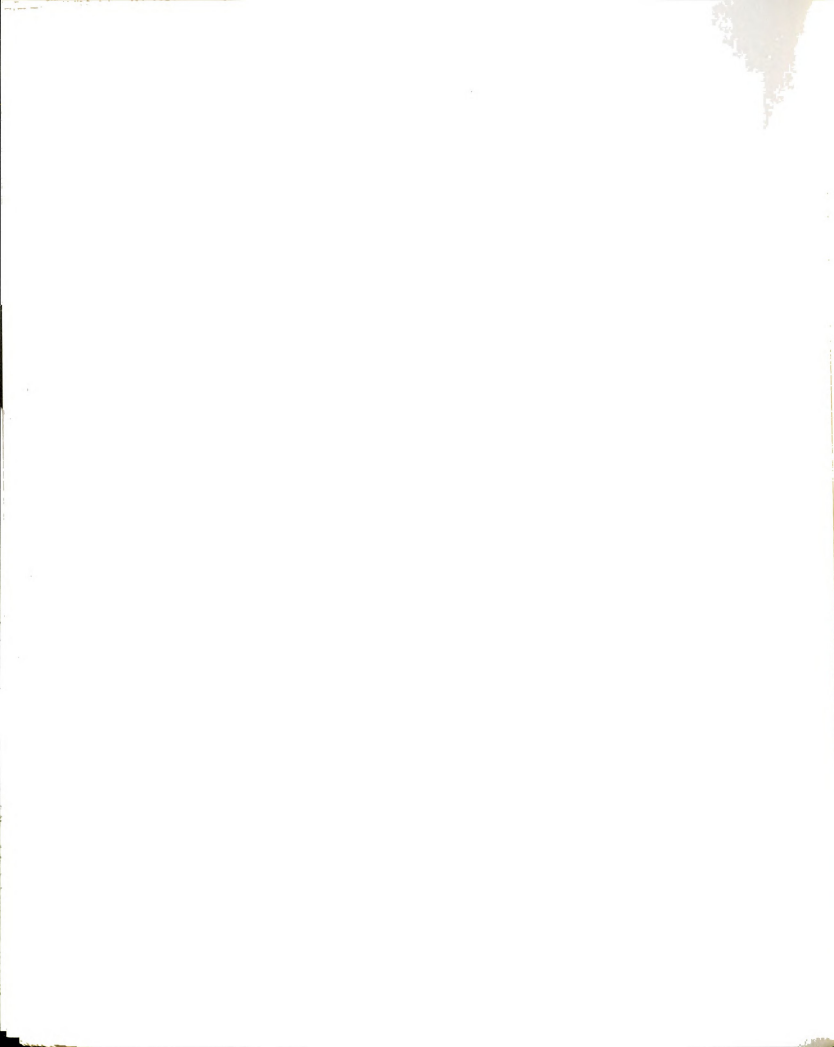
TABLE 8

DEVELOPMENT COST ESTIMATES BASED ON 1969
NATIONAL ASSOCIATION OF HOME BUILDERS DATA

Region	Mean Land Development Cost Per Front Foot by Regions(\$)	National Mean Lot Frontage (\$)	Development Cost per Lot (\$)
New England	25.	90	2250.
Mid Atlantic	36.	90	3240.
South Atlantic	29.	90	2610.
East South Central	27.	90	2430.
East North Central	37.	90	3330.
West North Central	33.	90	2970.
West South Central	24.	90	2160.
Mountain	32.	90	2880.
Pacific	44.	90	3960.

<u>Region</u>	<u>: States</u>
New England	: Maine, Vermont, New Hampshire, Massachusetts, Rhode Island, Connecticut
Mid Atlantic	: New York, Pennsylvania, New Jersey
South Atlantic	: Maryland, West Virginia, Virginia, D.C., N. Carolina, S. Carolina, Georgia, Florida
East South Central	: Kentucky, Tennessee, Mississippi, Oklahoma
East North Central	: Michigan, Wisconsin, Illinois, Indiana, Ohio
West North Central	: N. Dakota, S. Dakota, Nebraska, Kansas, Minnesota, Iowa, Missouri
Mountain	: Montana, Idaho, Wyoming, Nevada, Utah, Colorado, Arizona, New Mexico
Pacific	: Washington, Oregon, California, Hawaii, Alaska

Source: Sumicrast and Frankel (1970). Mean land Development Cost per Front foot by region from Table 29, page 150 and mean lot frontage from table 14, page 110.



Research which attempts to explain farm land values has found the following six factors statistically significant: 1) amount of land in farms, 2) farm transfers, 3) number of farms, 4) previous year net farm income, 5) rate of return on nonfarm investment and 6) land prices in the previous year (Healy and Short, 1979). Capital gains or appreciation of value and the expectations of capital appreciation are an important part of increasing farm real estate values. Certainly inflation and the increased product prices of 1973-1974, followed by increased farm enlargement, contributed to the increasing farm land values (Herr, 1974). That part of the appreciation affected by farm related factors should influence supply of land for urban uses. As farming becomes more rewarding the supply of land for urban uses should shift and the price increase.

Schmid pointed to the following factors which affect the ability or desire of landowners to withhold land from the conversion market. "There is no a priori reason that the reservation or asking price set by sellers should not be found to exceed the present value of actual future values, and no reason that this price could not persist over considerable time, even if there is no overt collusion and no combination by a few sellers." (1968, p.39). This reinforces the previous discussion of the role of expectations. Taxation can also affect the investment potential and affect the capitalization of land values. Finally, the cost of capital and degree of uncertainty and risk can affect the supply of land.

Van Vuuren (1976) argued that appreciation gains made by farmers in selling their farms for urban uses is not extensive because the

the opportunity cost should also include attachment to and knowledge of the land, transactions costs, etc. While many of these factors may be involved, the size of the appreciation seems to large to be explained solely by these factors.

Farm value data is published in two places: The Farm Real Estate Market Reports, published by the U.S. Department of Agriculture, and the U.S. Census of Agriculture. The first exists for the U.S. and states and is available on a yearly basis. The second is done every five years. The data are by county and states. While the Census of Agriculture data is superior and will be used in the empirical work to follow, success has occurred using The Farm Real Estate Market Reports.

Again, Schmid noted that the farm land price rose 150 percent from 1946 to 1964. (1968, p.9). From 1964 to 1976, however, the price of farm land increased by over 300 percent, keeping pace with the percentage increase in site price. This data was presented in Table 3. So while the percentage that farm values represented of site value was 2 percent in 1960, it was about 2.2 percent in 1976.

Conceptually the calculation of agricultural opportunity cost should entail finding the value of agricultural land without urban pressures. However, land values reported near urban areas have the urban pressure component included. To estimate the opportunity cost, the land use map of National Atlas of the United States (U.S. Geological Survey, 1970) was examined by counties and the counties listed which had a similar land use (i.e., field crops, irrigated farming, crops and grazing) to the agricultural areas around the urban areas of the state. The mean land values of the agricultural

counties in a given state was considered the agricultural opportunity cost for cities in that state. A finer, city by city, analysis was not possible without detailing the agricultural land uses around each city; a costly venture. In Michigan, for example, seventeen counties were listed.⁹ The average land and building value of these counties was \$563 while the average for the state was \$459. This conceivably indicates that the better agricultural land is around urban areas, which is the case in the lower peninsula of Michigan. The process of selecting the counties was essentially by examination of the land use map.¹⁰ This process seemed to expatiate several existent problems with state averages such as the inclusion of much forest or desert land and, in very urban states such as New Jersey, excessive inclusion of urban land. These counties, calculated from the 1969 Census of Agriculture, were also used for 1959, 1964 and 1974 calculations used in the pooled cross-sectional time series analysis.¹¹ See Appendix C.

⁹The counties were Allegan, Barry, Branch, Calhoun, Cass, Gratiot, Hillsdale, Ionia, Isabella, Lapeer, Lenawee, Mecosta, Montcalm, St. Joseph, Sanilac, Tuscola, and Van Buren.

¹⁰In a few instances prior knowledge by the author in such states as Oregon and Maryland and the knowledge of fellow graduate students supplemented the process. In one case, Colorado, a fellow graduate student described the sale by his father of a farm undergoing urban pressure and the purchase for quite a bit lower price of a similar farm further from the urban area.

¹¹Because of changes in the definition of a farm reported in the regular Census of Agriculture in 1974, the preliminary report data was used for calculating agricultural opportunity cost. The definitions of farms were, therefore, consistent for 1959, 1964, 1969, and 1974.

Appreciation

Site price appreciation is calculated as the percent appreciation over agricultural opportunity costs after development costs and agricultural opportunity cost adjusted for site size, are deducted. Thirty-six cities were common to both FHA and NAHB data. For these cities the calculation of appreciation from NAHB data is shown in Table 9 and the calculation of appreciation from FHA data is shown in Table 10. Site price and appreciation from both sources are summarized in Table 11 for thirty-six cities in 1969.

Birmingham, Alabama will be used to demonstrate the calculation. The NAHB site price for Birmingham was \$5451 in 1969. Development costs are estimated for Alabama as \$2430 and the calculated agricultural opportunity cost for Alabama was \$82, both for 1969. Development and agricultural opportunity costs are added together for a total of \$2512 and then subtracted from site price leaving a difference of \$2938. Appreciation is then calculated with respect to development costs at 117 percent and agricultural opportunity costs at 3570 percent. Appreciation varies between the FHA and NAHB data not solely because of site price. Agricultural opportunity cost is adjusted by 2.6 lots per acre for NAHB data and appropriate metropolitan area site size for the FHA data. Development cost from the NAHB source was adjusted on a national basis to FHA sites. Therefore, FHA site size information is likely to be more reliable than the constant 2.6 lots per acre assumed in the NAHB calculations for all cities. On the other hand, the development cost data from NAHB sources, while still a poor approximation across metropolitan

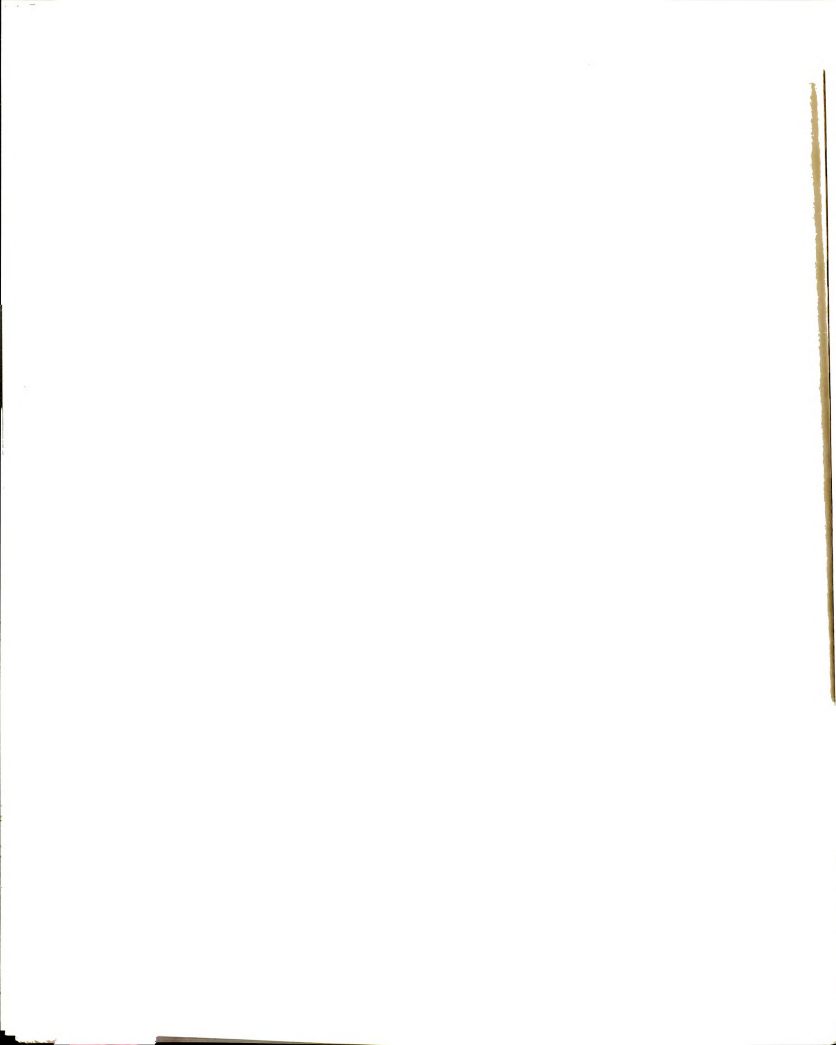


TABLE 2

SITE PRICE APPRECIATION ABOVE AGRICULTURAL
OPPORTUNITY COST AND DEVELOPMENT COSTS,
NAHB DATA, 1969 THIRTY-SIX CITIES

A. SITE PRICE	B. AGRICULTURAL COSTS	C. DEVELOPMENT COSTS	D. AGRICULTURAL OPPORTUNITY COST (BAC)	E. APPRECIATION (A-D)	F. PERCENT APPRECIATION OVER COSTS (F)-(D)-100	G. PERCENT APPRECIATION OVER AGRICULTURAL OPPORTUNITY COST (G)-(D)-100
(5)	(3)	(5)	(5)	(5)	(2)	(2)
1. Birmingham	5631.	2430.	2512.	2939.	117.	3570.
2. Mobile	5507.	2530.	2512.	1995.	79.	2623.
3. Sacramento	5798.	2700.	4143.	3600.	67.	3678.
4. San Francisco	1028.	2700.	4143.	6335.	131.	3668.
5. San Antonio	5877.	2800.	2917.	2960.	102.	8102.
6. Wilmington	8875.	2610.	2763.	6112.	221.	3982.
7. Tampa	4371.	2610.	2732.	1639.	60.	1340.
8. Atlanta	7281.	2610.	2708.	4573.	169.	4681.
9. Chicago	9847.	2610.	3330.	3330.	102.	1564.
10. Indianapolis	9847.	2610.	3330.	2512.	69.	1564.
11. Dallas	6533.	2610.	3330.	2512.	159.	4061.
12. New Orleans	7031.	2610.	2906.	4715.	204.	3276.
13. Baltimore	5931.	2610.	2798.	3133.	112.	1662.
14. Detroit	8172.	2610.	3645.	3133.	112.	1662.
15. Grand Rapids	5500.	2610.	3645.	1078.	31.	917.
16. Minneapolis	7500.	2610.	3096.	4446.	136.	3795.
17. Kansas City	5101.	2970.	3063.	2038.	67.	2199.
18. St. Louis	7027.	2970.	3063.	3964.	129.	4277.
19. Omaha	4918.	2970.	1083.	1835.	60.	1631.
20. Buffalo	5231.	2970.	1155.	2240.	50.	1631.
21. Cincinnati	8227.	3130.	3680.	4301.	126.	2860.
22. Cleveland	8227.	3130.	3680.	4747.	136.	3156.
23. Oklahoma City	5107.	2160.	2264.	3063.	137.	1653.
24. Tulsa	5275.	2160.	2264.	3011.	135.	1615.
25. Portland	5515.	2160.	4116.	1879.	109.	1579.
26. Philadelphia	7088.	3200.	3368.	3720.	111.	3629.
27. Pittsburgh	7088.	3200.	3368.	4093.	122.	3773.
28. St. Paul	3117.	2430.	2538.	579.	23.	533.
29. Nashville	4384.	2430.	2538.	1846.	73.	1702.
30. Dallas	6410.	2530.	2235.	4175.	163.	1739.
31. Ft. Worth	3546.	2160.	2235.	1110.	50.	1230.
32. Houston	3752.	2160.	2235.	1093.	163.	4235.
33. San Antonio	3752.	2160.	2235.	1522.	68.	2018.
34. Salt Lake City	7036.	2880.	2952.	4082.	138.	5676.
35. Richmond	5663.	2610.	2737.	2926.	107.	2305.
36. Seattle	6274.	3960.	4074.	2200.	54.	1776.

Sources: Site prices from NAB data for Cities and States (1969).

Development Costs entailed from NAB data for Cities and States (1969).
Percentages of Agricultural Opportunity Costs calculated as explained in Chapter IV and summarized in Appendix C.
Development Costs entailed from NAB data for Cities and States (1969).
Percentages of Agricultural Opportunity Costs calculated as explained in Chapter IV and summarized in Appendix C.

TABLE 10

SITE PRICE APPRECIATION ABOVE AGRICULTURAL
OPPORTUNITY COST AND DEVELOPMENT COSTS,
FHA DATA, 1969 THIRTY-SIX CITIES.

A	B	C	D	E	F	G
SITE PRICE	AGRICULTURAL OPPORTUNITY COSTS	DEVELOPMENT COSTS	AGRICULTURAL OPPORTUNITY COST + DEVELOPMENT COST (C+D)	APPRECIATION (A-D)	PERCENT APPRECIATION OVER COSTS (E)-(D) 100	PERCENT APPRECIATION OVER AGRICULTURAL OPPORTUNITY COST (E)-(B) 100
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1. Birmingham	2631.	1749.	1819.	616.	34.	879.
2. Hobbs	3586.	1250.	1548.	1038.	67.	1548.
3. Sacramento	4783.	2850.	2938.	1085.	63.	2130.
4. San Francisco	6711.	2073.	2932.	3799.	130.	6710.
5. Denver	3518.	18.	3091.	1427.	68.	7976.
6. Washington	3391.	1879.	1957.	1438.	73.	1853.
7. Washington	3391.	1879.	1937.	1817.	42.	1401.
8. Atlanta	3113.	80.	2631.	1310.	61.	1646.
9. Chicago	3982.	2397.	2696.	1310.	61.	2050.
10. Indianapolis	2912.	99.	2397.	415.	17.	419.
11. Louisville	3159.	1749.	1802.	1356.	75.	2583.
12. Cincinnati	3144.	1554.	1609.	3534.	220.	6472.
13. Cincinnati	3144.	1554.	1609.	2282.	116.	2758.
14. Detroit	3722.	1879.	1962.	1848.	93.	1848.
15. Grand Rapids	4160.	2397.	2696.	1421.	68.	1996.
16. Minneapolis	4103.	2138.	2237.	1866.	83.	1890.
17. Kansas City	3130.	2138.	2198.	932.	42.	1569.
18. Omaha	3607.	2138.	2186.	1421.	65.	3004.
19. Omaha	3607.	2138.	2199.	968.	43.	1507.
20. Buffalo	3645.	2397.	2696.	1089.	40.	1507.
21. Cincinnati	4368.	2397.	2696.	1089.	40.	2096.
22. Dayton	4479.	2397.	2696.	1089.	40.	2110.
23. Indianapolis	2642.	1555.	1599.	842.	53.	1910.
24. Portland	2642.	1555.	1599.	1201.	75.	2710.
25. Portland	3591.	2851.	2962.	584.	20.	534.
26. Philadelphia	3359.	2333.	2696.	1089.	40.	1507.
27. Pittsburgh	3852.	2333.	2696.	1089.	40.	2011.
28. Knoxville	3047.	140.	1889.	1157.	61.	826.
29. Dallas	3280.	96.	1749.	1436.	78.	1521.
30. Dallas	3280.	96.	1749.	1436.	78.	1521.
31. Ft. Worth	2727.	1555.	1594.	1588.	100.	4099.
32. Houston	3003.	1555.	1597.	1284.	70.	2652.
33. San Antonio	2678.	1555.	1597.	1810.	116.	2500.
34. Lake City	3209.	2074.	2116.	1092.	52.	2559.
35. Raleigh	3428.	95.	1974.	1654.	74.	1535.
36. Seattle	4213.	2851.	2915.	1300.	45.	2050.

Sources: Site prices from Sundt and Frankel (1970).

Agricultural Opportunity Costs calculated by State as explained in Chapter IV, and Summarized in Appendix C.
Development Costs from Sundt and Frankel (1970). Also see Table 8.

TABLE 11

COMPARISON OF LAND VALUE APPRECIATION AND MARKET PRICE OF SITE
FOR THIRTY-SIX CITIES COMMON TO BOTH NATIONAL ASSOCIATION OF HOME
BUILDERS AND FEDERAL HOUSING ADMINISTRATION DATA 1969

CITY	SITE PRICE NAHB (\$)	SITE PRICE FHA (\$)	APPRECIATION NAHB (%)	APPRECIATION FHA (%)
1. Birmingham	5451.	2343.	3570.	879.
2. Mobile	4507.	3586.	2423.	2252.
3. Sacramento	5798.	4783.	906.	2130.
4. San Francisco	10478.	6731.	3468.	4710.
5. Denver	5877.	3518.	8102.	7976.
6. Wilmington	8875.	3391.	3982.	1852.
7. Tampa	4371.	2754.	1339.	1401.
8. Atlanta	7281.	3313.	4681.	1587.
9. Chicago	9847.	3982.	3505.	2050.
10. Indianapolis	5897.	2912.	1564.	419.
11. Louisville	6543.	3159.	4061.	2543.
12. New Orleans	7021.	5144.	3225.	6472.
13. Baltimore	5931.	4244.	1662.	2758.
14. Detroit	8172.	3722.	4110.	2407.
15. Grand Rapids	4500.	4160.	917.	1955.
16. Miami	7240.	4103.	3295.	1889.
17. Kansas City	5101.	3130.	2199.	1568.
18. St. Louis	7027.	3607.	4276.	3003.
19. Omaha	4918.	3148.	1622.	1547.
20. Buffalo	5231.	3445.	1631.	1677.
21. Cincinnati	7781.	4368.	2859.	2493.
22. Dayton	8227.	4479.	3156.	2109.
23. Oklahoma	5307.	2442.	3653.	1909.
24. Tulsa	5275.	2801.	3615.	2709.
25. Portland	5515.	3547.	895.	524.
26. Philadelphia	7068.	4359.	3429.	3330.
27. Pittsburgh	7441.	3852.	3773.	2071.
28. Knoxville	3117.	3047.	533.	826.
29. Nashville	4384.	3280.	1701.	1521.
30. Dallas	6410.	3182.	5537.	4099.
31. Ft. Worth	3546.	2722.	1738.	2652.
32. Houston	5428.	3403.	4235.	4874.
33. San Antonio	3757.	2678.	2018.	2580.
34. Salt Lake City	7034.	3209.	5675.	2559.
35. Richmond	5663.	3428.	2305.	1535.
36. Seattle	6274.	4215.	1925.	2049.

Sources: Sumicrast and Frankel (1970) for NAHB data.

FHA, Data for Cities and States, 1969.

Also see Table 9 for NAHB data and Table 10 for FHA data.

areas of variations, would seem more reliable for the NAHB calculations than for the FHA calculations, given that the FHA data is from a different segment of the market. Ideally, site size, development cost, and agricultural opportunity cost would exist for each metropolitan area. Lacking that ideal, the best available data for each data set has been used.

Summary of the Land Conversion Process

There are a series of steps in the land conversion process which will be summarized from the sections above.

It is generally assumed that most land converted to urban residential uses was initially farm land. The active farm value is the initial point of departure, but the opportunity cost of alternatives available to the farmer in terms of farms with similar agriculture not under urban pressure represents the base from which the process begins conceptually. In this research an effort is made to estimate the value of land and buildings, though land alone would have been preferred, of farms similar to farms under urban pressure, at least by State.

If the farmer sells to a speculator or holds on to the land for speculative purposes, the role of expectations with respect to the general and specific growth of the metropolitan will come into play. Economic rent arises from this urban population growth. The ability of the farmer or non-farmer speculator to keep land off the market until prices rise depends upon various holding costs such as, among others, the property tax or in some cases sewer charges.

The next step is the purchase by the subdivider. After a holding period which can vary substantially from several months to three years, the developer puts in government mandated or consumer demanded improvements for urban uses. (Sumicrast and Frankel, 1970). The developer then sells the land, or perhaps, builds a house on it. The size of the site will often depend upon the price (and vice versa) and development costs will vary according to demands from buyers and local jurisdictions for different improvements. Appreciation represents both economic rent and monopoly profit after agricultural opportunity cost and the normal returns and development costs are subtracted from site price.

The chapters to follow empirically attempt to explain the variation across cities and over time for site price and appreciation for both the FHA and NAHB data. While this is an effort to discern supply, demand, and instrumental features, it is unlikely in the near future, given the data situation, that a single model will be successfully identified.

CHAPTER V

CROSS-SECTIONAL REGRESSION ANALYSIS

Introduction

This chapter consists of three primary sections. The first section introduces the operational form of the independent variables. The second section estimates a cross-sectional regression model for site price and the third section estimates a cross-sectional regression model for appreciation. A brief analysis of sewer financing precedes the conclusion.

There are four objectives of the cross-sectional regression work to follow. First, more recent data will be used to complement earlier results for basically the same models. The estimates of the models with more recent data will be compared to earlier results and changes noted.

Second, the analysis will entail use of both site price data and the calculated appreciation estimates. This will allow for continuity with most previous econometric research.

Third, variables associated with the institutional issues of interest in this research will be introduced. This will include property taxation, sewer provision, and sewer financing variables. In addition, some variables thought to have institutional significance in the other econometric studies, reviewed in Chapter III, will be examined.

Fourth, and last, the analysis will use both FHA and NAHB data for the dependent variables. This will highlight variations in the data sets which could influence further analysis which uses one or the other source of data.

Independent Variables

Chapter IV developed the city variation and trends over time for site price and appreciation, the dependent variables in this research. This section will present a detailed description of the independent variables and the hypothesized relationship to the dependent variables, consistent with the theory presented in Chapter II and the literature review presented in Chapter III. This section will be concluded by a formal presentation of the site price and appreciation models. Cross-sectional regression analysis will follow.

The independent variables can be roughly categorized into three groups. The first group consists of general demand variables such as total population, change in population, and mean family income. These variables appeared in the earlier research reviewed in Chapter III. The second group is composed of characteristics implicit in the land site such as site size, development cost, and agricultural opportunity cost. These variables are used in part to calculate appreciation from site price. The third group consists of the instrumental variables related to sewer provision and tax policies. The variables are instrumental in that the variable reflects policies subject to political decisions. Each of the independent variables in these three groups is discussed below. Each variable is also

summarized for both the cross-sectional and pooled regression analysis in Table 12.

General demand characteristics are introduced into the model through the use of variables for total population, percentage change in population, mean or median family income and a dummy variable to represent cities in California. Each of these is discussed below.

Size of the metropolitan population encompasses several aspects of demand. Larger cities cost more to live in and often provide more amenities so prices in general are higher the greater the total population. Moreover, because of the generally larger area or increased congestion, some amenities such as schools, businesses, parks, cultural activities will be spread further from a given location or site. Lots on the fringe of a larger city will be further away from some of the amenities in the metropolitan area whether the metropolitan area is monocentric, policentric or even banana shaped. For example, a Detroit residential fringe lot is further away from the Renaissance Center in downtown Detroit than a fringe lot in metropolitan Kalamazoo is from the Kalamazoo Convention Center. More undeveloped land is within easy reach of most metropolitan amenities in a smaller city and traffic congestion is often less of a problem. Indeed, there may be fewer amenities in general in the smaller city which, therefore, could mean less demand for close-in fringe land. It should be noted, however, that the shape or structure of the metropolitan area does introduce some ambiguity into this relationship. The dispersal of amenities throughout a large metropolitan area will also disperse demand at the fringe or expand the area considered the fringe. The exact size and implications of this effect on site

TABLE 12

DESCRIPTION AND SOURCE OF INDEPENDENT VARIABLES USED IN
SITE PRICE AND APPRECIATION MODELS¹

- A. Total Population (persons), Urbanized Area, 1970, U.S. Census of Population, 1970.
- B. Change in Population (percent), Urbanized Area, 1960-1970, U.S. Census of Population, 1970.
- C. Mean Family Income or Median Family Income (dollars), Urbanized Area, 1970, U.S. Census of Population, 1970.
- D. Calculated Agricultural Opportunity Cost per acre (dollars), 1959, 1964, 1969, 1974, U.S. Census of Agriculture. Calculated for counties which have similar use as urbanized counties but are free of urbanizing value impacts. See Chapter IV for detailed discussion.
- E. Development or Improvement Costs per lot (dollars), 1969, National Association of Home Builders (Profile of the Builder and His Industry) 1970. See Chapter IV for detailed discussion and Table 8 for calculation by U.S. region.
- F. California Dummy Qualitative dummy variable where value of one if city is in state of California and zero other wise.
- G. Percent All (Single Family) Homes With Public Sewer, SMSA's and places over 100,000 persons, 1970. U.S. Census of Housing, 1970.
- H. Percent New (Single Family) Homes With Public Sewers, SMSA's, 1967-1976, FHA Data for States and Selected Areas 1967-1976. SMSA's reported each year varied because of sample size criterion.
- I. Property Tax Proportion of General Revenue (percent), 1967, Census of Local Government, 1967.
- J. Site Size (square feet), 1967-1976, SMSA's, FHA Data for States and Selected Areas, 1967-1976. SMSA's reported each year varied because of sample size criterion.

- K. Property Tax Range: Calculated by subtracting low county average per capita property tax in SMSA from high county average per capita property tax in SMSA and dividing by overall SMSA average per capita property tax thus resulting in a relative range. Where one county consists of entire SMSA, the range is zero. Census of Local Government, Financial Characteristics of Selected Metropolitan Areas, 1964-1975.
- L. Sewer Range: Calculated the same as the property tax range but uses the per capita sewer capital outlay, high, low, and overall averages. Census of Local Government, Financial Characteristics of Selected Metropolitan Areas, 1964-1975.
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¹Variables used in the pooled cross-sectional time series regressions include total population, percent of new homes sewerred, property tax range, sewer range, development costs, site size, and agricultural opportunity costs. When data were not available for a specific year, linear interpolations or extrapolations were made. Selection of the number of cities and years chosen for analysis was made based on minimizing interpolations or extrapolations because of their effect on the degrees of freedom.

price or appreciation is unclear given interaction with other variables associated with total population such as income.

Percent change in population can be viewed as both an indication of recent past increases in demand and as a portent for future growth. The greater the percentage increment in population the greater will be the demand, hence, price for residential lots. The degree of that effect could depend on the housing stock, etc. but this might be mitigated somewhat by the ten year period used in the population change variable. The initial housing stock effect might wash out over the ten year period. Furthermore, landowners at the fringe would naturally look at past growth trends as an indication of future growth and economic rent. As expectation of increasing demand is greater, then some greater proportion of the supply of land is withheld in anticipation of increased prices, increasing current prices. The best form of this concept would be an indication or projection of future growth.

The mean or median family income variable indicates by size the strength of demand or buying power of an area. People with higher incomes are able to pay or bid more for lots with more amenities or locational advantages. It's generally recognized that the mean weights the extreme values more heavily while the median is more stable and generally lower than the mean. The implications of the two income variables will be discussed with the results.

Regional variation in population growth, weather, demography, etc. could lead to variations in site price and appreciation either through demand or development costs associated with weather, input costs, etc. Preliminary statistical analysis indicated the

possibility of land market conditions in California varying in size if not characteristically from the rest of the country. Therefore, limited examination of regional variations was indicated by the use of a dummy variable for cities in the State of California.

The second group of variables concern site characteristics and include development costs, agricultural opportunity cost, and site size.

There are two possible interpretations of the relationship between development costs and the dependent variables. If, as is generally assumed in this research, the supply of sites is fixed, then price is demand determined and appreciation is a residual affected by the size of development costs as demonstrated in Figure 2. The supply of sites is unaffected by development costs while appreciation is inversely related to development costs.

On the other hand, development costs could affect the supply of sites as shown in Figure 3. Development costs in this case are positively related to site price and appreciation. High development costs, in this case, would be associated with a smaller supply and higher prices for sites and, presumably, greater appreciation. This research will use the assumption of a fixed supply where price is demand determined while recognizing that the assumption of supply determined by development costs could also be valid.

Agricultural opportunity cost should be positively related to site price because of the higher price needed for urban uses in order to meet the offer price of the landowner to cover opportunity costs. If the variable definition has captured any demand characteristics, those characteristics will add to the positive relationship.

FIGURE 2. DEVELOPMENT COSTS WITH THE SUPPLY OF SITES FIXED

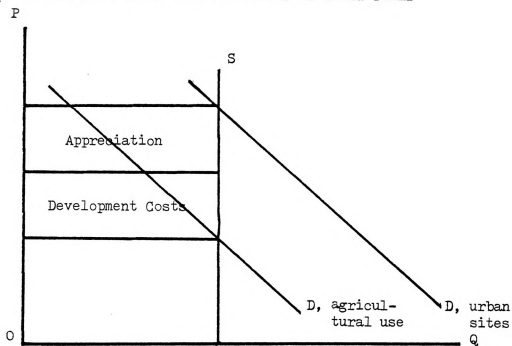
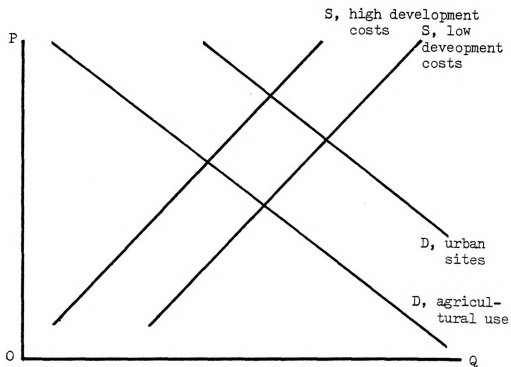


FIGURE 3. DEVELOPMENT COSTS AS DETERMINING SITE SUPPLY



Finally, over time, the size of a lot has decreased as the price of the site has increased. Moreover, it can be assumed that across cities that as the price of the site increases the size of the lot will decrease, *ceteris paribus*.

The instrumental variables used in the cross-sectional analysis include percent all homes with public sewer, percent new homes with public sewer, the property tax proportion of general revenue (percent), the property tax range and the sewer range.

Either percent all homes with public sewer or percent new homes with public sewer could indicate the sewer supply policies followed in a metropolitan area. Percent all homes with public sewer could indicate the cumulative influence and historical policies of local jurisdictions while percent new homes with public sewer would indicate recent policy. The greater the percentage of either all or new homes with public sewer, the more likely that sewers are being supplied which require hook ups. Site price and appreciation should be higher if this is the case. On the other hand, liberal provision of sewer services when there is demand could be the policy followed.

While the greater supply of public sewers could lead to scattered residential location as well as an under-supply, the raw land price might be less with over-supply as the increased improvement costs show up in the site price. On the other hand, under-supply also raises prices. Therefore, while either of these variables could indicate past sewer supply policies, the variables are somewhat ambiguous on price and appreciation. However, the role of sewer costs in site improvement might override the supply characteristics and indicate that a larger percent of lots with public sewer would lead to a higher

site price. It should be noted, though, that if this facet of sewer provision is important, it could lead to smaller appreciation. Care should be taken with these variables. The lack of sewer supply variable data for new sites results in the use of these poor proxies.

The property tax variables include the property tax proportion of general revenue (percent) and the relative range of average per capita property tax paid across counties in a metropolitan area. The property tax proportion of general revenue is an indication of the importance of the property tax vis-a-vis other local government financing methods. The property tax is a less direct way of financing new infrastructure than connection fees or service charges so the greater the use of the property tax the greater raw land prices will be. According to Clawson, "the extent that the house purchaser evades any of the costs of public services to his property, the raw land price will be higher than if he had to pay them." (1971, p.162). The percentage of sewer financing with user charges is also tested for data available for seventeen cities in 1960. But also note, that high property taxes, per se, lowers home value and, therefore, site value. True value of a home includes site value and construction costs. Therefore higher property tax reduces derived demand for homes but may decrease the cost of development.

The property tax range was calculated by subtracting the low county average per capita property tax in the SMSA from the high county average per capita property tax in the SMSA and dividing by the overall SMSA average per capita property tax thus resulting in a relative range. Where one county consists of entire SMSA the range is zero. The sewer

range is calculated the same as the property tax range but uses the per capita sewer capital outlay high, low, and overall averages. Since the basic units are the counties in SMSA's, the great variation in county size from one SMSA to another SMSA raises serious issues about the usefulness of the relative range in this context.

The range of the average per capita property tax can be indicative of two phenomena. First, the range may indicate the disparity between the central city and the suburbs. If, as seems likely, the central city has the greatest average per capita property taxes paid then the flight to the low tax suburbs could be indicated. This would indicate that the greater the range the greater the demand, hence, price. Also captured in the range is variation across subjurisdictions. It is, however, a crude measure since the range is across counties in an SMSA, where as many jurisdictions are involved. As a proxy for the variance which cannot be compared across different populations because distributions cannot be assumed the same and small number of cases for some cities, the range captures several effects which make the interpretation of the relationships of interest ambiguous. However, as the average per capita property tax is related to income and demands for amenities associated with the property tax, it can also be assumed that the range can also be indicative of income and have a positive relationship to site price and appreciation.

The range of the average per capita sewer capital outlay should indicate another supply variable. If the central city can be considered to be completely sewered (not counting replacement), then the greater the range the greater the current outlay on sewers in

the fringe. Following the theory of the other sewer supply variables, the greater the supply the greater the site price and appreciation.

A final note is needed to point to some of the interactions between the independent variables. For example, there should be a strong correlation between sewer supply variables and the total population of the metropolitan area. As population becomes greater and generally denser, the need for public sewers becomes greater because of the inability of the land to absorb waste with septic tanks and other techniques. Tax variables could be highly correlated with income. As population and income increase, the demands for services also increase and so taxes should also increase. With a greater income range the variation in demand (and tastes) might also be reflected in tax and sewer range variables.

This review of the operationalization of the model and variables can be summarized for both the site price and appreciation models in the following equations:

Site Price = α		Expected Relationship
B_1	Total Population (persons)	+
B_2	Change in Population (percent)	+
B_3	Mean or Median Family Income (dollars)	+
B_4	California Dummy	+
B_5	Site Size (square feet)	-
B_6	Improvement Costs (dollars per site)	-
B_7	Agricultural Opportunity Cost (dollars)	+
B_8	Property Tax Proportion of General Revenue (percent)	+
B_9	Property Tax Range	+
B_{10}	Sewer Range	+
B_{11}	All Single Family Homes with Public Sewer(%) or	?
	New Single Family Homes with Public Sewer(%)	?

where

α = Constant to be estimated.

B_1 to B_{11} = Coefficients associated with specified variables.

The appreciation model below consists of two groups of variables. The demand variables used in the site price model are carried over since demand is a key determinant of rent and profit, the theoretical components of appreciation. In Chapter IV, site size, development cost, and agricultural opportunity cost were used to calculate appreciation from site price. These variables cannot be used to explain appreciation since they were used to calculate appreciation: site size less agricultural opportunity cost (adjusted by site size) and less development cost (adjusted by site size) is equal to land value appreciation.

Several variables will be tested only in the site price model. The California Dummy and the Property Tax Proportion of General Revenue (percent) were not considered accurate enough variables to be tested in both models unless they were reasonably strong in the site price model. In this case, as will be demonstrated, neither variable was statistically significant. The other instrumental variables are the property tax range, sewer range and percent all or new homes with public sewers. These variables are intended to explain appreciation via the hypothesized relationships associated with public policies restricting supply and leading to profit.

The model is:

Appreciation = α	Expected Sign
+B ₁ Total Population (persons)	+
+B ₂ Change in Population (percent)	+
+B ₃ Mean or Median Family Income (dollars)	+
+B ₄ Property Tax Range	+
+B ₅ Sewer Range	+
+B ₆ All Single Family Homes with Public Sewer (percent) -or- New Single Family Homes with Public Sewer	?

Where:

α = Constant to be Estimated.

B₁ to B₆ = Coefficients Associated with Specified Variables.

Site Price Model

Introduction

Both the site price and appreciation models were estimated by ordinary least squares. Because of missing data for some variables, the entire model is not examined in any one equation. Statistically insignificant variables are dropped so that the equations which follow have fewer independent variables than they would normally have if the entire model were examined in one equation, hence gaining degrees of freedom.

This section builds upon precedents discussed in Chapter III. There was, as earlier, no strong a priori suspicion of heteroskedasticity in the cross-sectional analysis. An examination of the residuals did not indicate a problem. However, as with previous research, there is an indication of some multicollinearity. While

this raises issues about the interpretation of the variables it was not judged serious.

The independent variables thought to be associated with site prices are examined with data from FHA and NAHB for 1969. The results of the fourteen equations used to estimate the site price model are displayed in Tables 13, 14 and 15. The following analysis consists of two approaches. First, a step by step description of the selection criteria for dropping or adding variables will be made. This will proceed through the model using NAHB data and the variables related to that model. Then the same will be done using FHA data. This will be followed by regressions of the same independent variables and same observations for each data set. Secondly, analysis will be made of the statistical significance and sign of the independent variables as reflected in the fourteen equations.

Description of the Method

To reiterate, there are two reasons for the sequentially estimated equations to follow: 1) to test relationships with the largest number of cases possible and 2) to examine issues raised in earlier econometric work. This process will now be briefly described.

Ottensmann (1977) estimated an equation using 1964 NAHB site data similar to the equation estimated in Table 13, regression one, which is, however, for 1969 NAHB site data. The results are similar to those of Ottensmann with significance levels of $\leq .0001$ for total population, $\leq .0001$ for income and .478 for change in population. Ottensmann's coefficient of determination (R^2) was .53 for 1964 compared to .42 for the 1969 data used in this section. The signs were positive.

TABLE 13

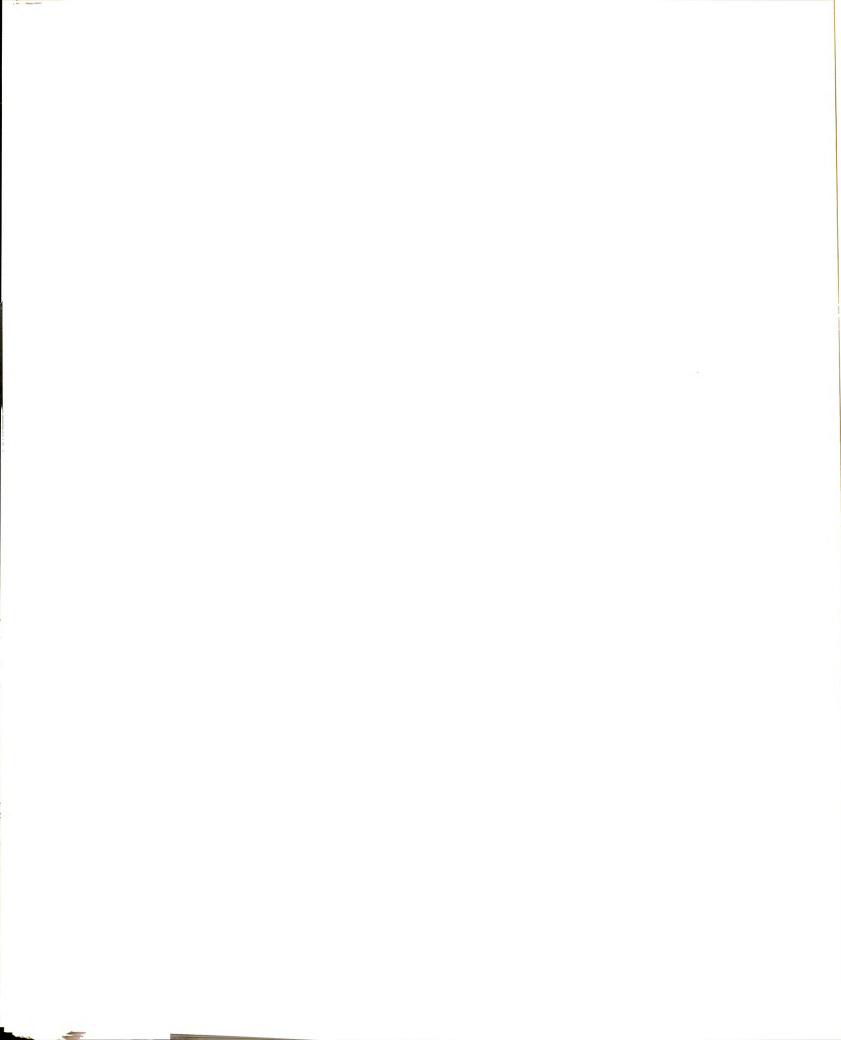
SITE PRICE REGRESSIONS, NAHR, 1969

Dependent Variable/ Regression Number	Independent Variables														Constant	R ²	R ⁻²	# of Cases
	Regression Coefficient, Standard Error In Parenthesis, Significance Level																	
Site Price	Total Population 1970 (persons)	Change in Population 1960-1970 (percent)	Median Family Income 1970 (dollars)	Agricultural Opportunity Cost 1969 (dollars)	Development Costs 1969 (dollars)	California Dummy ¹	All Homes With Public Sewer 1970 (percent)	Property Tax Range ² 1969	Sewer Range ³ 1969									
Regression One	.0008 (.0001) ≤.0001	3.1755 (4.7419) .478	.5033 (.0959) ≤.0001															
Regression Two	.0009 (.0001) ≤.0001	10.9242 (4.5213) .017		5.1526 (.8330) ≤.0001	.0529 (.2040) .796	-80.4584 (595.3595) .893												
Regression Three	.0005 (.0002) .008	-4.6265 (12.7375) .718		8.7160 (1.7627) ≤.0001			44.3846 (15.6442) .007	2090.8625 (747.7128) .007	-2.5964 (127.697) .984									
Regression Four	.0003 (.0002) .058		.4089 (.1569) .012	8.0282 (1.6658) ≤.0001			41.5794 (14.4458) .006	2117.0461 (701.0598) .004	-15.6855 (117.5362) .894									

¹ Qualitative dummy variable where cities in the State of California were one and all other cities were zero.

² Calculated by subtracting low county average per capita property tax in SHSA from high county average per capita property tax in SHSA and dividing by the overall SHSA average per capita property tax thus resulting in a relative range. Where one county consists of entire SHSA the range is zero.

³ Calculated the same as property tax range but uses the per capita sewer capital outlay high, low, and overall averages.



This equation provides the initial reference point for the other equations to follow. It also indicates problems mentioned in the review of other research on the correlation between some of the independent variables. Specifically the simple correlation of income with total population was .40 and .21 for percent change in population. Table 13, regression two, was estimated, therefore, without income but with agricultural opportunity cost, development cost, and a California dummy added for the 162 cases. The results showed percent change in population now statistically significant at the .017 level and agricultural opportunity cost and total population statistically significant at the $\leq .0001$ level each. All of the signs were positive. Development cost and the California dummy were insignificant, hence, dropped. Both of these variables could be considered as proxies for regional variations across the U.S. Their lack of statistical significance might indicate the need for an even finer grain in regional analysis. A conclusion supporting the importance of regional variation came from comments by developers interested in national variations in development costs (Chapter VIII).

Regression three of Table 13 included only fifty-six cities with the addition of percent all with public sewer, property tax range and sewer range as well as total population, percent change in population and agricultural opportunity cost. As expected, total population and agricultural opportunity cost were significant (.008 and $\leq .0001$, respectively) as well as percent all homes with public sewer (.007) and the property tax range (.007). All of the significant variables had positive coefficients. Sewer range was insignificant as well as change in population. Regression four, Table 13, replicated regression

three save for the replacement of change in population by median family income. This was done because of the possibility of income factors entering with the new variables. The addition of income not only increased the R^2 from .57 to .62 but income was statistically significant at the .012 level and had a positive coefficient.

Table 14 traces four equations estimated for 1969 FHA site price data. Regression one of Table 14 begins the FHA site price analysis for 104 cities. The independent variables were total population, change in population, mean family income, agricultural opportunity cost, site size and the property tax proportion of general revenue. Total population, change in population and agricultural opportunity costs were significant at the $\leq .0001$, .001, $\leq .0001$ levels respectively. Mean family income and percent new homes with public sewer were significant at the .165 and .013 levels and carried over to the next equation. The signs of these five variables were, as hypothesized, positive. Site size and the property tax proportion of general revenue were significant at the .401 and .456 levels and not carried further.

Regression two in the FHA site price analysis added the property tax range and sewer range to the five variables carried over. There were fifty cities in regressions two, three, and four. The R^2 dropped from regression one (.55) to regression two (.51). Total population and agricultural opportunity cost were significant at .019 and $\leq .0001$ levels respectively. Change in population declined to a significance level of .125. Percent new homes with public sewer was significant at the .318 level with a positive coefficient. The income, property tax range and sewer range variables were insignificant.

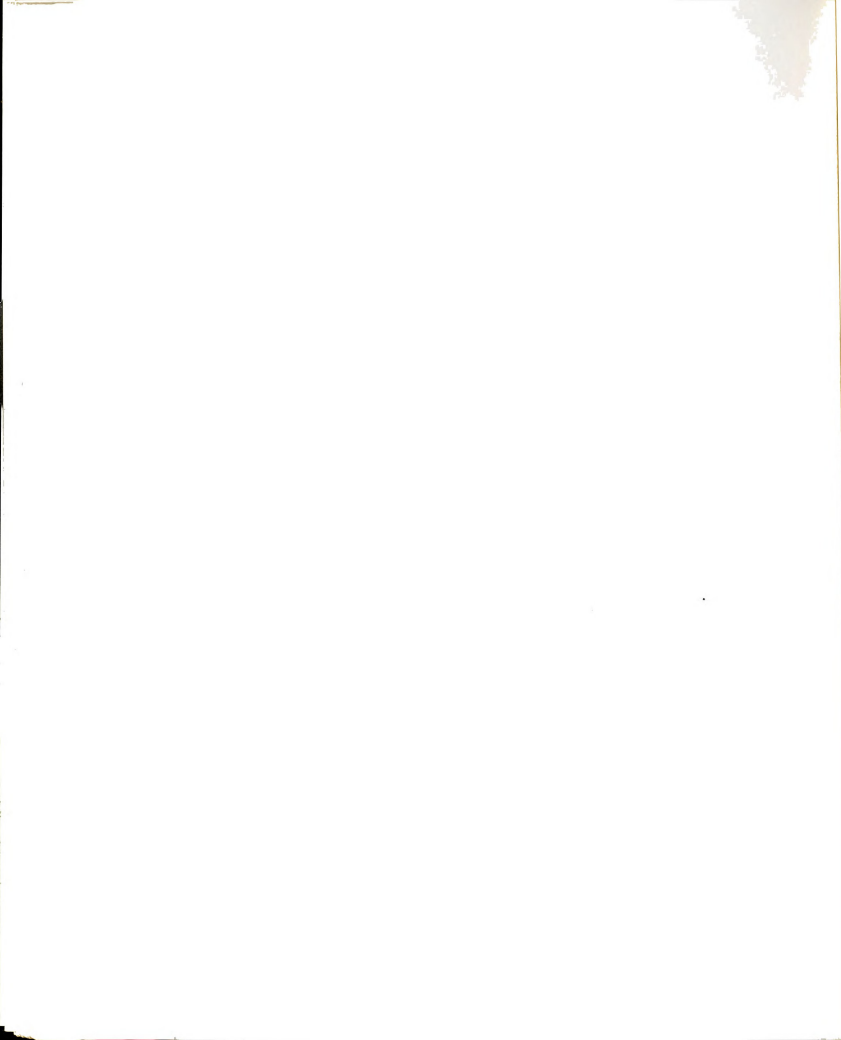
TABLE 14

SITE PRICE REGRESSIONS, FIA, 1969

Dependent Variable/ Regression Number	Market Site Price, Federal Housing Admin- istration 1969 (dollars)	Total Population 1970 (persons)	Change in Population 1960-1970 (percent)	Mean Family Income 1970 (dollars)	Agricultural Opportunity Cost 1969 (dollars)	Site Size 1969 (square feet)	Property Tax Proportion of General Revenue 1970 (percent)	New Homes With Public Sewer 1969 (percent)		Property Tax Range 1969	Score Range 1969	Constant	R^2	R^2	f of Cases
Regression One		.00017 (.00006)	17.4063 (4.9861)	1243 (.0926)	6.8938 (1.2620)	.0270 (.0320)	-2.1964 (2.9121)	10.0080 (3.9121)				-376. (899.)	.55	.51	104
Regression Two		.00014 (.00005)	18.8217 (12.0098)	.0382 (.1382)	6.6977 (1.6424)			5.9218 (5.8096)		73.3602 (244.4426)	-17.4190 (109.2112)	1017. (1190.)	.51	.42	50
Regression Three		.00016 (.00005)	19.6920 (11.4657)	.783 (.093)	6.8578 (1.5206)			6.3000 (5.6913)		76.5027 (241.7693)	-8.6257 (103.3480)	1304. (380.)	.51	.44	50
Regression Four		.00011 (.00005)	17.4078 (11.8067)		7.1571 (1.5028)			15.6648 (12.4016)		-3.1865 (244.2632)	-16.5633 (101.3639)	668. (995.)	.51	.44	50
		.053	.168					.213		.990	.873	.488			

¹ Calculated by subtracting low county average per capita property tax in SMSA from high county average per capita property tax in SMSA and dividing by the overall SMSA average per capita property tax thus resulting in a relative range. Where one county consists of entire SMSA the range is zero.

² Calculated the same as the property tax range but uses the per capita outlay high, low and overall averages.



Regression three and four continued the property tax range and sewer range variables but dropped income. The only difference between regression three and regression four is the change from percent new homes with public sewer to percent all homes with public sewer. The results were essentially the same except that the statistical significance of total population and change in population were less with the use of percent all homes with public sewer.

Casual comparisons of the NAHB Table 13 regression three with the FHA Table 14 regression four, indicated different results with respect to the statistical significance of the same independent variables and coefficients of determination (R^2). Since comparable independent variable data existed for the thirty-six cities for both the NAHB and FHA site price variable, regressions were estimated specifying the exact same independent variables for the NAHB and FHA site price variables. A comparison was made of possible differences arising from the use of median family income in the NAHB series and mean family income in the FHA series. The comparison between the median and mean on each data set for the thirty-six cities indicated no significant difference.

On the other hand, the equations estimated for the thirty-six cities in Table 15 indicate clear differences in the ability of the model to explain NAHB and FHA data for site prices. The NAHB equations, regressions 1, 3, and 5, had R^2 's of .65, .69, and .70 sequentially while the exact same independent variables when used to explain the FHA data, regression 2, 4, and 6, had sequential R^2 's of .50, .48, and .51. Furthermore, the property tax range and percent all homes with public sewer were statistically significant in the NAHB equations

TABLE 15
SITE PRICE REGRESSIONS FOR THIRTY-SIX CITIES COMMON TO NAHB AND FHA FOR 1969

Dependent Variable/ Data Source/ Regression Number	Independent Variables										Constant	R ²	R ²
	Regression Coefficient, Standard Error In Parenthesis, Significance Level												
	Total Population 1970 (persons)	Median Family Income 1970 (dollars)	Mean Family Income 1970 (dollars)	Change In Population 1960-1970 (percent)	Agricultural Opportunity Cost 1969 (dollars)	All Homes With Public Sewer 1970 (percent)	Property Tax Range 1969	Sewer Range ² 1969					
Market Site Price 1969													
NAHB Regression One	.00037 (.00017) .041	.2640 (.1960) .189			7.0689 (2.0144) .001	51.3284 (17.7735) .007	2574.6632 (863.4662) .006	-49.8327 (148.3422) .739	.65	.58			
FHA Regression Two	-.0000798 (.0001051) .454	.2194 (.1171) .071			5.1025 (1.2040) ≤.0001	15.7572 (10.6230) .149	225.0730 (516.0842) .666	-25.0476 (88.6625) .780	.50	.40			
NAHB Regression Three	.00030 (.00016) .059		.4621 (.1993) .028		5.9807 (1.9946) .006	43.1096 (17.4170) .019	2426.4962 (816.4581) .006	-91.2666 (141.8646) .525	.69	.62			
FHA Regression Four	-.00005653 (.00010638) .599		.1806 (.1289) .172		4.8769 (1.2902) .012	14.6529 (11.2657) .204	134.1712 (528.1027) .801	-38.6948 (91.7611) .676	.48	.37			
NAHB Regression Five	.000218 (.000182) .241		.5671 (.2181) .015	-20.06 (16.30) .228	5.3636 (2.0044) .012	46.99 (17.48) .012	2547. (807.) .004	-6027. (2061.) .007	.70	.64			
FHA Regression Six	-.00013 (.00011) .254		.2624 (.1395) .070	-14.56 (10.42) .173	4.4510 1.2821 .002	17.75 (11.18) .123	251.14 (561.65) .631	-1437. (1318.) .285	.51	.41			

¹ Calculated by subtracting low county average per capita property tax in SHSA from high county average per capita property tax in SHSA and dividing by the overall SHSA average per capita property tax thus resulting in a relative range. Where one county consists of entire SHSA the range is zero.

² Calculated the same as the property tax range but uses the per capita sewer capital outlay high, low, and overall averages.

but insignificant or suspicious in the FHA equations. Agricultural opportunity cost remained highly significant while the income variables were somewhat significant. Population change was essentially insignificant as was total population in most of the equations. While at first perhaps surprising it would seem likely that both total population and population change would be less important given the likelihood that all of the thirty-six cities were large as a result of matching the data sets.¹²

Further implications of the difference between NAHB and FHA data will be explored following a similar comparison made with appreciation as the dependent variable. Care should be taken, however, not to directly compare the equations because of the different dependent variables. Also, part of the difference in the coefficients of determination could be the higher average site price of the NAHB data. The concern here is with the possibility of different conceptual and operational models for the NAHB and FHA data.

Interpreting the Results

The results of the previous equations will be interpreted using the three categories of independent variables used for the site price regressions: demand variables, site characteristic variables, and instrumental variables.

¹²The mean was \$6175 and the standard deviation was \$1679 for the NAHB regressions 1, 3, and 5 while the mean was \$3619 and standard deviation was \$842 for FHA regressions 2, 4, and 6.



The general demand variables used were total population, percent change in population and mean or median family income. While various statistical issues such as multicollinearity have existed in this as well as earlier research, it seems clear that these variables contribute some explanatory power to any model of inter-urban land values. Total population, population change, and income explain a reasonably large proportion of the variation in site price. Rent theory postulates that demand plays an important role in determining the price over a relatively inelastic supply of land. These demand variables, therefore, confirm the strength of that postulated relationship. Total population has both demand and supply characteristics. The geographical size and density inherent in the census calculation of an urbanized area perhaps reveals preferences based upon past patterns of development and the supply of land accessible to different urban facilities.

The instrumental variables included property tax proportion of general revenue, property tax range, percent all or new homes with public sewer and the sewer range.

The two tax related variables had ambiguous results. The property tax as a proportion of general revenue was not statistically significant and probably was a crude variable definition to get at the distinction between property tax and user charge methods of financing public facilities. The property tax range was statistically significant in the NAHB regressions while there were poor statistical results in the FHA regressions. The NAHB success is suggestive but the complex role of the property tax in the land conversion process



makes interpretation difficult. While the results are ambiguous, the relative success of a fairly crudely defined variable in this model points to the need for further work and possibility of some importance of property tax variations in explaining site price variations.

The three sewer supply variables also met with mixed success. The percent all or new homes with public sewers variables were both statistically significant and again reinforces the potential returns to further research into public service supply variable definitions. This includes both the direct cost characteristics and the supply influencing characteristics. The sewer range which was defined much the same as the property tax range was not statistically significant.

Site characteristics included site size, improvements cost, agricultural opportunity cost and the regional (California dummy) variable. Statistically site size, improvement cost, and the regional variable were not significant. However, site size in Witte's (1975) research was quite important. How much of the difference in results between Witte and this research is attributable to the use of a different functional form is unclear. What does seem clear is that the basic price/quantity relationship that links site size and site price is economically significant and not unimportant to the analysis of other factors such as development costs and zoning. Because of the definition of development costs and the suspicion that intra-regional variations might be greater, because of city size, for example, the insignificance of the development cost variable was not surprising.

Agricultural opportunity cost was highly significant in every equation for site price. The definition of the variable made some



effort to take account of state variations in price for agricultural land. The persistent statistical significance supports the economic significance implied by policies designed to affect the agricultural opportunity cost. Policies that affect holding costs, affect supply. While, as noted in Chapter IV, the definition of agricultural opportunity cost attempted to eliminate urban influences by using rural counties as proxies for agricultural opportunity cost, the methodology was crude. If not successful then this variable is probably capturing urban demand effects.

Appreciation Model

Description of the Method

As in the analysis for site price, the regression work on appreciation includes a series of equations using both NAHB and FHA data and testing different independent variables with varying numbers of observations. Following this procedure, equations will be estimated for the thirty-six cities common to NAHB and FHA data, similar to the site price analysis.

Table 16 presents three regressions each for NAHB and FHA appreciation. NAHB and FHA regressions one, two, and three, respectively, use the same set of independent variables. The equations vary not only by data source and calculation of the dependent variable, appreciation, but also by the number of complete cases available for each regression.

NAHB regression one and FHA regression one from Table 16 duplicate the introduction of the demand variables of total population,



TABLE 16

APPRECIATION REGRESSIONS, MAH, FIA, 1969

Dependent Variable/ Data Source/ Regression Number	Regression Coefficient, Standard Error in Parenthesis, Significance Level	Independent Variables					Constant	R ²	F of Cases
		Change Population 1960-1970 (percent)	Mean Family Income 1970 (dollar)	All Homes With Public Sewer 1970 (percent)	Property Tax 1969	Sewer Range 1969			
Land Value Appreciation, 1969	Total Population 1970 (persons)	13.34 (5.35)	-.04516 (.10840)	48.54 (15.53)	1731.67 (748.85)	226.94 (130.17)	1980. (1009.)	.13	.11 162
	MAH Regression One	.0006152 (.0001497) ≤.0001	.618	.003	.022	.087	.051		
Land Value Appreciation, 1969	Total Population 1970 (persons)	2.64 (13.02)	.1279 (.1689)	48.54 (15.22)	1731.67 (748.85)	226.94 (130.17)	-24.39 (12.06)	.39	.33 56
	MAH Regression Two	.0001382 (.0001610) .395	.087	.003	.022	.087	.049		
Land Value Appreciation, 1969	Total Population 1970 (persons)	.00007141 (.00017120) .618	.434	.002	.022	.076	-37.18 (20.34) .073	.40	.34 56
	MAH Regression Three								
FIA Regression One	Total Population 1970 (persons)	.371 (.0885) ≤.0001	.0009521 (.0012540) .650	.2163 (.0893) .020	3.8484 (1.7533) .311	-.76175 (1.60650) .638	1.98 (11.50) .836	.24	.22 104
	FIA Regression Two	.000002472 (.000000857) .006	.4272 (.1789) .021	.0009521 (.0012540) .650	3.8484 (1.7533) .311	-.76175 (1.60650) .638	-7.2617 (1.60650) .638	.32	.24 50
FIA Regression Three	Total Population 1970 (persons)	.000000083 (.000000541) .291	-.001627 (.001955) .410	.0009521 (.0012540) .650	1.8240 (1.7225) .627	-1.0330 (1.6106) .325	-24.67 (19.22) .206	.34	.27 50
	FIA Regression Three								

¹ Calculated by subtracting the low county average per capita property tax in SRA from high county average per capita property tax in SRA and dividing by the overall SRA average per capita property tax thus resulting in a relative range. Where one county consists of entire SRA the range is zero.

² Calculated the same as the property tax range but uses the per capita sewer capital outlay high, low, and overall average.



change in population, and mean family income. The significance levels are roughly comparable with a significance level of $\leq .0001$ for total population and .014 for change in population in NAHB regression one and .008 for total population and $\leq .0001$ for change in population for FHA regression one. The signs were positive as expected. Mean family income was insignificant. The R^2 was .13 for the NAHB equation (162 cases) and .24 for the FHA equation (104 cases).

NAHB regression two and FHA regression two dropped mean family income and added all homes with public sewer, property tax range and the sewer range. Change in population decreased slightly in significance while total population became insignificant in the NAHB regression. However, in the NAHB equation, all homes with public sewer were significant at the .003 level while the property tax range and sewer range were significant at the .026 and .087 levels respectively. In the FHA equation the variable for all homes with public sewer was significant at the .030 level while the property tax range and sewer range were insignificant. The R^2 jumped from .13 to .39 for the NAHB regressions and from .24 to .32 for the FHA regressions. NAHB regression two had 56 cases and FHA regression two had 50 cases.

Regression three for each city swapped mean family income for population change in order to discern any interaction between the instrumental variables and income. No significant changes were noted for the instrumental variables or R^2 (.40 and .34 for NAHB and FHA respectively). However, total population now became insignificant in both equations showing some interaction with income where little existed with change on population.

Several issues arising out of this analysis were pursued for thirty-six cities common to both NAHB and FHA appreciation models. Both NAHB and FHA regression one in Table 17 include total population, mean family income, percent all homes with public sewer, the property tax range and sewer range. The results were roughly similar with total population, income and sewer range insignificant and percent all homes with public sewer and the property tax range significant at the .006 and .017 levels in the NAHB regression and .001 and .204 in the FHA equation. Dropping the sewer range and adding change in population did not change the results significantly. The total population, income, and change in population results could, as with the site price results, arise from the large city bias in the thirty-six cases.

Interpreting the Results

Total population and percent change in population seem to contribute to the explanation of appreciation when the sample sizes are large enough to include greater variation. Even so population change remained a strong contributor with samples of 50 or more. This persistent statistical significance as compared to weaker results in the site price model could indicate a greater role of expectations in appreciation. Income was persistently insignificant. Theory would indicate that income would affect the elasticity of demand and, hence, the amount of profit which could result from product differentiation or supply restrictions. Better results should be expected but possible interaction with total population or the functional form



TABLE 17
APPRECIATION REGRESSIONS FOR THIRTY-SIX CITIES COMMON TO NAIM AND FIA, 1969

Independent Variable/ Dependent Variable/ Regression Number	Regression Coefficient	Standard Error	Independent Variable	Significance Level	Constant	R^2	R^2
Land Value							
Appreciation, 1969							
Naim Regression	Mean Family Population 1970 (percent)	Mean Family Population 1970 (dollars)	All Homes With Public Sewer 1970 (percent)	Change in Population 1960-1970 (percent)	Property Tax Range 1969	Sewer Range 1969	
Naim Regression One	-.00000016 (.00000021) .462	-.0283 (.2480) .910	66.7646 (22.5632) .006	2714.17 (1073.89) .017	-3621. (2568.) .163	-5059 (189.29) .998	.37 .27
FIA Regression Two	-.00000071 (.0002113) .371	-.1901 (.2453) .443	83.8507 (22.2275) .001	1372.41 (1057.80) .204	-3079. (2530.) .233	-21.0500 (184.1186) .910	.35 .24
Naim Regression Three	-.0002216 (.0002439) .371	-.0868 (.2673) .748	63.59 (23.97) .010	11.18 (21.27) .603	2583. (1080.) .023	-3095. (2758.) .271	.38 .27
FIA Regression Four	-.0000318 (.0000411) .386	-.1651 (.2653) .537	83.2854 (22.9342) .001	-5.7272 (21.0351) .787	1417.18 (1068.68) .195	-3133. (2726.) .231	.35 .24

¹ Calculated by subtracting low county average per capita property tax in SHSA from high county average per capita property tax in SHSA and dividing by the overall SHSA average per capita property tax thus resulting in a relative range. Where county consisted of entire SHSA the range is zero.

² Calculated the same as the property tax range but uses the per capita sewer capital outlay high, low, and overall averages.



could be causing a problem. Each of the demand variables would seem to be economically significant. However, the land conversion market appreciation process might not work as hypothesized.

The instrumental variables tested in the appreciation equations were percent all homes with public sewer, property tax range and sewer range. The property tax proportion of general revenue was dropped because of the site price results and a lack of conviction into operational definition.

Percent all homes with public sewer was statistically significant and positive. This could be interpreted as encouragement for further refined definitions of variables related to public service provision. While some of the ambiguities have already been discussed, it is evident that the statistically significant and positive association between appreciation and sewer provision does tend to support the hypothesized relationship that sewer provision affects the size of appreciation. However, the sewer range was generally insignificant with the exception of Table 16, NAHB regressions two and three (.087 and .074 significance level respectively). The results are not strong enough to offer much encouragement for this particular operational definition.

The property tax range was also significant in the NAHB appreciation regressions. This encourages further analysis on the role of property tax variation in explaining both site price and appreciation.



Methods of Sewer Financing and Raw Land Prices

As detailed in Chapter II sewer user or service charges are periodical charges to the users of a sewer system, whether owners or renters, based upon the extent of their use of the sewer system (Tabors, et al, 1974.) It was noted by Clawson (1971) that raw land prices will be greater the more costs of the sewer are evaded presumably through the property tax. That is, the greater use of sewer user charges will be reflected in smaller raw land prices.

Data for 1960 sewer user charges were available from Downing (1969) for twenty metropolitan sewer districts. Seventeen of these districts had NAHB raw land price data for 1960 as well as data for total population, mean family income, and the calculated agricultural opportunity cost.

The sewer charge data seemed crude in that it was unlikely that the metropolitan variation was captured in the data as reported. A regression was attempted with raw land price as the dependent variables and sewer user charges, total population, mean family income, and calculated agricultural opportunity cost as the independent variables.

The data and regression results are reported in Table 18. The coefficient of determination was .58 but the variable indicating the percent of the sewer system paid for by sewer user charges was insignificant at .791 level of significance. The result is not particularly surprising given the size of the sample and the sewer district as the unit of observation, even though some of the units covered a significant proportion of the metropolitan area. Another definition of this variable might yield better results. Uncertain data, poor variable definition operationalization and the likelihood of complex

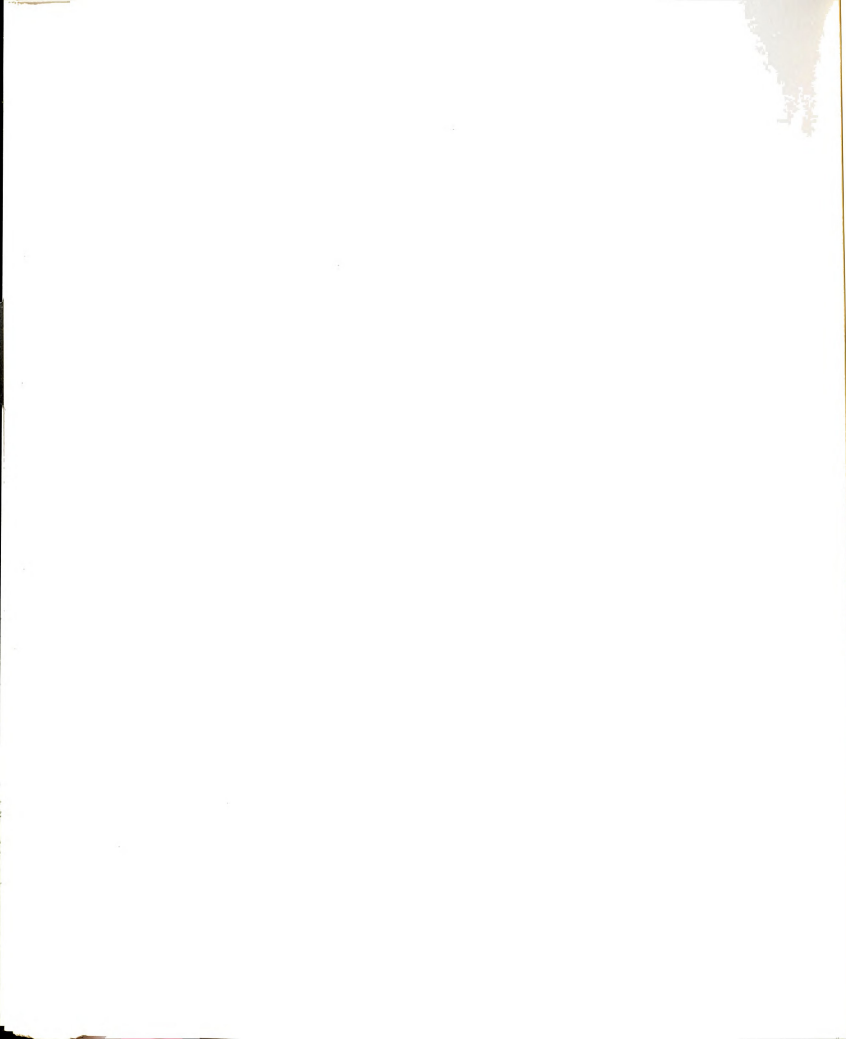


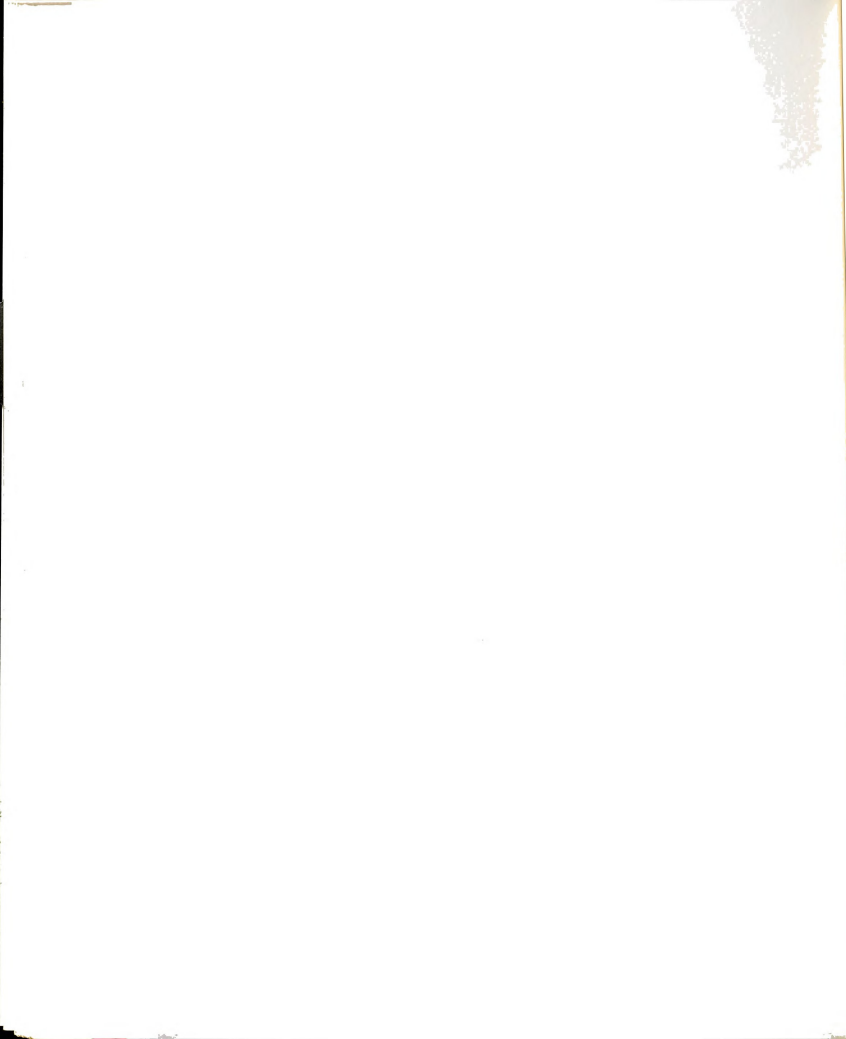
TABLE 18

EFFECT OF SEWER CHARGES ON RAW LAND PRICE, 1960 FOR SEVENTEEN CITIES

Metropolitan Area	\$ Per Raw Land Per Acre, NAHB 1960	Percent Financed ¹ by User Charges	Total Population (persons)	Mean Family Income (\$)	Calculated Agricultural Opportunity Cost (\$)
Boston	1728.	0	2413236	6622.	252.
Chicago	4758.	0	5959213	7292.	328.
Cincinnati	2479.	100.	993568	4101.	253.
Cleveland	2083.	78.	1784991.	6967.	253.
Detroit	3845.	100.	3537709.	6838.	189.
Los Angeles	8851.	0	6488791.	7073.	367.
Milwaukee	2296.	0	1149997.	7036.	178.
Philadelphia	1850.	100.	3635228.	6437.	150.
Pittsburgh	3078.	100.	1804400.	6106.	150.
Portland	4718.	57.7	651685.	6522.	246.
San Francisco	8167.	0	2430663.	7073.	367.
Toledo	2097.	100.	438238.	6579.	253.
Washington, D.C.	3379.	100.	1808423.	7603.	174.
Buffalo	1353.	37.5	1054370.	6394.	151.
Green Bay	1700.	0	97162.	6162.	178.
Madison	1750.	86.	157814.	6928.	178.
St. Louis	4222.	91.3	1667693.	6301.	122.
Regression Results:	B	2.94	.0003	.32	16.22
	St. Error	10.86	.0002	.59	7.13
	Significance	.791	.225	.598	.042

Sources: Raw Land Price from Schmid (1968), User Charge from Downing (1969), Total population, mean family income from Census of Population, Ag. Opp. Cost from author.

¹Otherwise Financed by Property Tax, see Table 1.



interaction between sewer financing, taxation and the land market argue for further thinking.

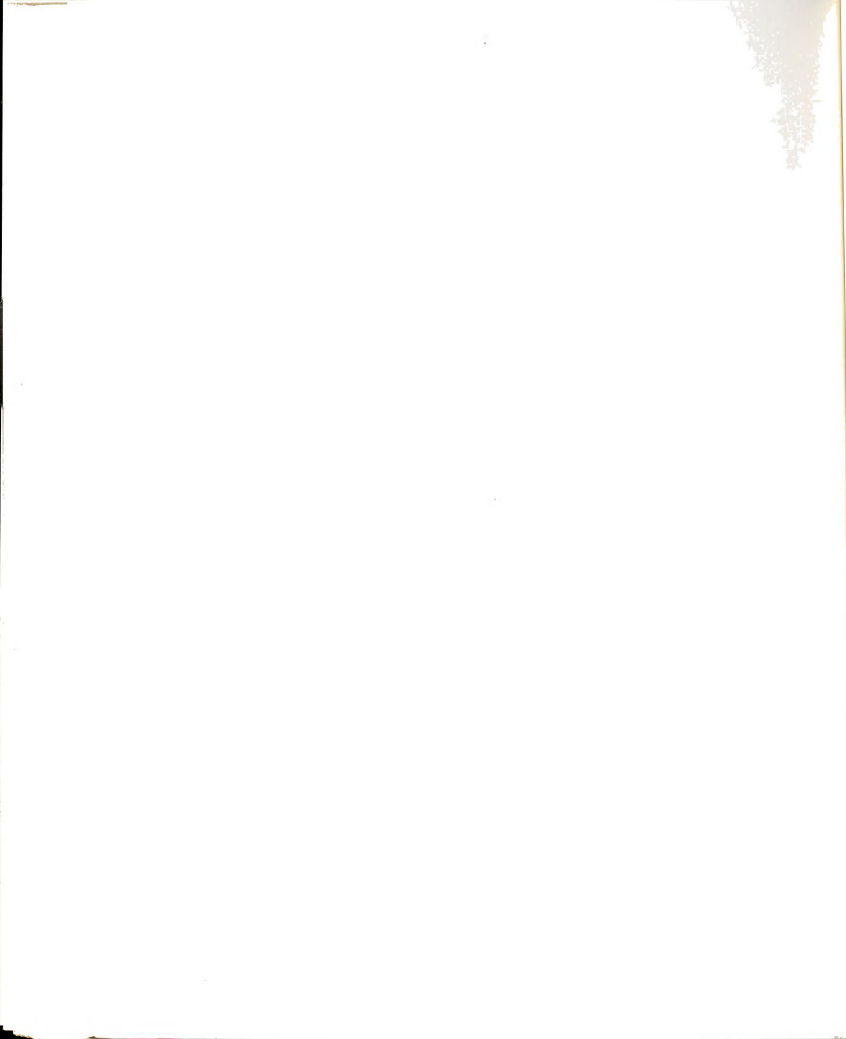
Conclusions

The cross-sectional analysis in this chapter used data for 1969 from both NAHB and FHA sources. The contrast of results between the NAHB and FHA for the site price and appreciation variables indicates the potential need to interpret the data sets differently. The FHA data probably have fewer sampling errors but represents a lower price range of the housing market than does the NAHB data. The NAHB data could have a larger sampling and measurement error and represent both a larger and higher spectrum of the market. The difference in the explanatory power of the models tested could reflect differences in the markets analyzed as well as statistical reasons associated, for example, with larger average site prices in the NAHB data. Also, the greater statistical significance of percent change in population in the FHA series could indicate greater demand for lots which are smaller and presumably closer to existant development.

The regressions for site price and appreciation improved upon earlier work by introducing instrumental supply variables heretofore unexamined. Several of these variables, all or new homes with public sewerage and the property tax range, contributed to the explanatory power of the models and were generally quite robust in terms of statistical significance. The ambiguity of their interpretation should nevertheless limit their economic interpretation and implications for policy.

Contrasting the results of site price and appreciation indicates both similarities and differences. The demand variables were essentially consistent across both site price and appreciation for total population and change in population. Income, however, was not useful in explaining appreciation. Percent all or new homes with public sewer and the property tax range contributed to both models. Even the sewer range was successful for the NAHB appreciation model for the larger number of cases. The success of these variables augurs well for further research efforts.

Finally, while the results of the cross-sectional regression analysis are encouraging, the lack of statistical significance of such variables as income and, at times, total population, as well as others, is cause for caution. The model could be misspecified theoretically or in terms of variable definitions. The real world activities might not function at all like the theory developed here has hypothesized. The variables defined here are crude and may not capture the theoretically hypothesized effect. These issues ameliorate any interpretation of these results. Further conclusions on the econometric analysis will follow the pooled regression results.



CHAPTER VI

POOLED CROSS-SECTIONAL AND TIME SERIES ANALYSIS

Introduction

For some of the metropolitan areas examined in the cross-sectional analysis, the availability of FHA site price data for a significant number of years provided the opportunity to examine the theoretical model with pooled cross-sectional and time series data. The pooling of cross-sectional and time series data introduces the issue of the stability of the cross-sectional relationships over time: Do the independent variables vary over time, over cities, or both? Several circumstances argue for the pooling of data. Examination of the stability of some of the relationships over time can only be attempted by pooling because there were not sufficient observations for separate time series estimates. Pooling also increases the degrees of freedom from which it may be assumed that more precise estimates of the coefficients result. However, the pooling of data introduces problems in the interpretation of the combined cross-sectional and time-series effects. Kuh noted that "cross-sections typically will reflect long run adjustments whereas annual time series will tend to reflect shorter run reactions." (1959, p.207-208). When combined these separate effects will be complicated by their interaction. At this stage the theory developed for the cross-sectional analysis will be used and the results of introducing time and time-city effects examined a posteriori.

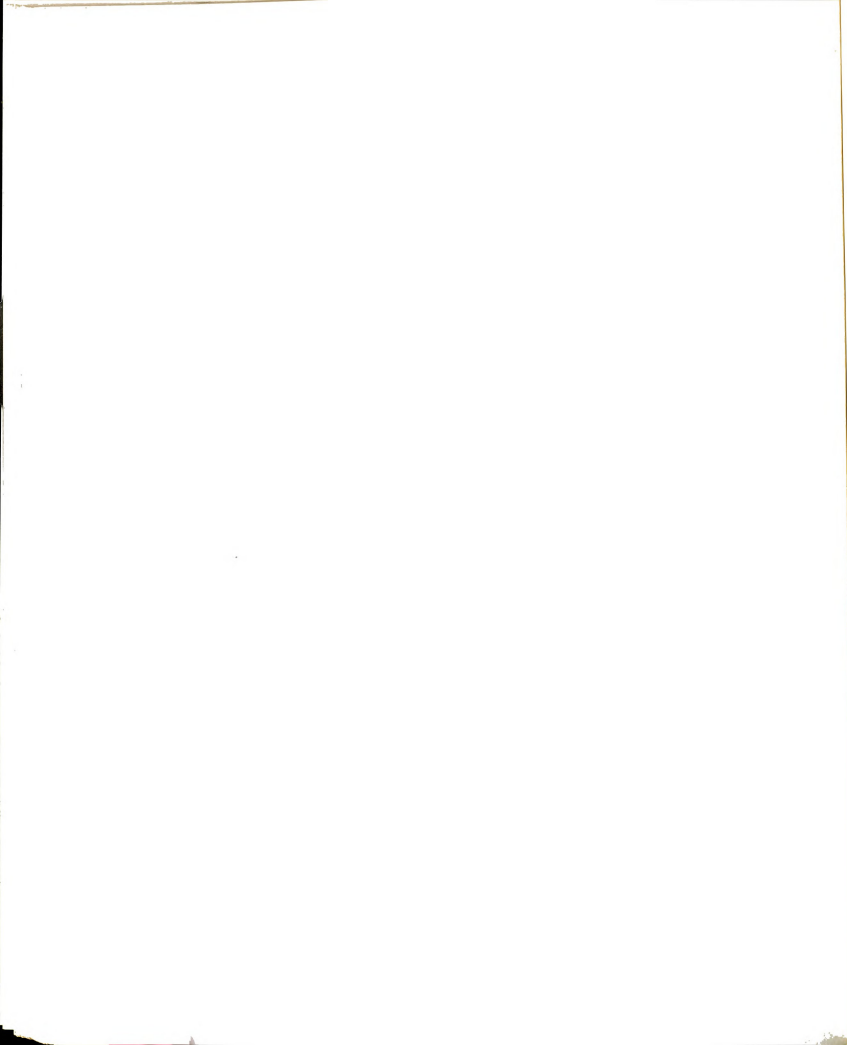


There were two steps followed in this chapter. First, a random subsample with complete data for the variables of interest was selected from the pooled cross-sectional and time series data base. There were ten cities used for the years 1967-1970. This subsample was used to test for the applicability of the simple OLS with pooled data (OLS-pooled) as contrasted with various forms of the covariance analysis generalization of the OLS model; that is, the analysis of covariance model (ANCOVA) with time dummies (ANCOVA-TE), city dummies (ANCOVA-XE), and time and city dummies (ANCOVA-TEXE). The results of this test were taken into consideration in application to the remainder of the data base and for alternate sets of independent variables, which depended primarily on data availability.

Some precedent for choosing to look at pooled data was provided by Witte (1975) who developed a pooled regression model with time dummies. Witte's results were summarized in Table 2.

Witte's purpose was to further analyze the hypothesis that the regression model developed cross-sectionally (or the vector of regression coefficients) was equal across years. The results were promising. "The average size of residential sites (SS) and the current annual family income (Y) are the variables which have the largest relative effect on the price of residential sites. The two indirect measures for the price of raw land¹³ have the next largest relative effects with change in population (HH) having the least effect on the price of residential sites" (1975, p.361).

¹³The two indirect measures are the value per acre of agricultural land and a measure of population density (population per square mile) (Witte, 1975).



The next section will build upon the methodology suggested by Witte, a covariance model with time dummies and also test the theoretical model developed earlier using all forms of the analysis of covariance model.

Test of the Covariance Model

Description of the Method

The theoretical model to be tested in this section is as follows:

$$\text{Site Price} = f(\text{Total Population,} \\ \text{Agricultural Opportunity Cost,} \\ \text{Property Tax Range,} \\ \text{Sewer Range,} \\ \text{Percent New Homes with Public Sewer})$$

With the exception of sewer range these variables were quite robust in the cross-sectional analyses. At this stage it is assumed that the cross-sectional relationships should be similar when pooled with time series observations.

The analyses of covariance approach used in this research was detailed by Pindyck and Rubinfeld (1976). The first step used for analysis of the pooled data is to simply combine the city and time series data and perform ordinary least squares regression (OLS-pooled). The intercept and slope are assumed constant over time and across cities. This may be an unreasonable assumption. The analysis of covariance model is a generalization of the ordinary least-squares model which introduces dummy variables which allow for the intercept to vary over time and to vary across cities. Pindyck and Rubinfeld maintained that, "if this model were estimated using ordinary least



squares, unbiased and consistent estimates of all parameters (including the slope β) would be obtained." (1976, p.204) Research by Johnson and Lyon (1973) on statistical models for combining cross-section and time series information concluded that,

the results of the experiments suggested that researchers having access to multiple cross-section samples would be well-advised to explore the analysis of covariance estimator. This is true since it is relatively easy to apply, and statistical testing for the significance of the effects is quite direct. If only aggregate data are available, the researcher must be aware of potential aggregation bias and make an effort to secure an unbiased estimate of one or more of the parameters by utilizing one of the restricted estimators. (p.473).

The analysis of covariance model was used in this research because of its simplicity and the exploratory nature of pooling data in this research area. Indeed, the results could indicate the nature of the aggregation bias and hence the kind of restricted estimators to be used in further research.

Several other problems with the covariance model should be noted. First, the use of dummy variables does not identify the variables which cause the regression line to shift over time or across cities. However, the array of the regression coefficients (high positive to high negative) rank cities or years relative to each other and, at least, provides for a source of speculation on excluded variables and aggregation issues. Nevertheless, the contribution of the city and time dummies is as a group and individual standard error and significance levels are not of statistical significance and are hence not reported.

Second, the loss of degrees of freedom by the use of dummies may decrease the statistical power of the model. However, statistical



testing by use of an F test helps the choice of whether to use ordinary least squares or to sacrifice degrees of freedom by using the covariance model. Pindyck and Rubinfeld explain the process as follows:

The test involves a comparison of the residual sum of squares associated with the two estimation techniques. Since the ordinary least-squares model includes more parameter restrictions than the covariance model (the intercepts are restricted to be equal over time and over individuals), we would expect the residual sum of squares to be higher for the ordinary least-squares model. If the increase in the residual sum of squares is not significant when the restrictions are added, then we conclude that the restrictions are proper and ordinary least squares can be applied. If the residual sum of squares changes substantially, we opt for the covariance model. In our model the appropriate test statistic would be ...

$$F = \frac{(ESS_1 - ESS_2)/(N + T - 2)}{(ESS_2)/(NT - N - T)} \quad ^{14}$$

Where ESS_1 = residual sum of squares using OLS

ESS_2 = residual sum of squares using covariance model

The numerator represents the increase in the residual sum of squares divided by the number of additional degrees of freedom when moving from the covariance model to ordinary least squares model, while the denominator represents the residual sum of squares for the covariance model divided by the number of degrees of freedom in the covariance model. On the null hypothesis that the equal intercept restrictions are correct, the F statistic follows the F distributions with $N + T - 2$ and $NT - N - T$ degrees of freedom. (1976, p. 205).

¹⁴ N = Number of cross-sectional units.

T = Number of time periods.

"In this most elementary pooling technique, there will be $NT - 2$ degrees of freedom (since estimation of the two parameters uses up two degrees of freedom)." Pindyck and Rubinfeld (1976, p.203).



This preliminary analysis has the four steps implied above. Initially the theoretical model is estimated using ordinary least-squares (OLS-pooled). Then a covariance model with time dummies (ANCOVA-TE) and city dummies (ANCOVA-XE) are separately estimated. Finally a covariance model is estimated with both time and city dummies (ANCOVA-TEXE).

Interpreting the Results

The results of the four models for the pre-test data are shown in Table 19. There were a total of ten cities for the years 1967-1970. These cases were the complete cases in the randomly selected subsample chosen for testing the covariance model.

The OLS-pooled model was consistent with the cross-sectional results and also consistent with the results of Witte (1975). Total population, agricultural opportunity cost and percent new homes sewerred were quite significant (.002, $\leq .0001$, $\leq .0001$, respectively) while the property tax range was significant at the .154 level and the sewer range was significant at the .444 level. All of the signs were positive. The R square was .86 and the adjusted R square was .84.

The ANCOVA-TE model which added time dummies led to no substantial changes in the significance of the independent variables. Furthermore, while the R squared remained unchanged the adjusted R squared dropped to .83. Using the aforementioned F statistic, the null hypothesis that the equal intercept restrictions are correct was supported. Hence the introduction of time dummies failed to improve the explanatory power over the OLS-pooled.



TABLE 19

TEST OF COVARIANCE MODEL FOR SITE PRICE, 1967-1970
TEN CITIES: 40 CASES

Model	OLS-POOLED	ANCOVA-TE	ANCOVA-XE	ANCOVA-TEXE
R Squared	.86	.86	.98	.98
Adjusted R Squared	.84	.83	.97	.97
Residual Sum of Squares	14372096.	1401211.	1715293.	1321744.

Model/Independent Variables	Regression Coefficients	Standard Error ¹	Significance ¹
--------------------------------	----------------------------	--------------------------------	---------------------------

OLS-POOLED

Total Population (persons)	.00025	.00007	.002
Agricultural Oppor- tunity Cost (dollars)	8.37	1.74	≤ .0001
Percent New Homes With Public Sewer	39.09	9.81	≤ .0001
Property Tax Range ²	504.36	345.51	.154
Sewer Range ³	52.93	68.74	.444
(Constant)	-2868.99	1091.07	.013

ANCOVA-TE

Total Population (persons)	.00027	.00008	.002
Agricultural Oppor- tunity Cost (dollars)	7.8566	1.6213	≤ .0001
Percent New Homes With Public Sewer	36.2874	10.7006	.002
Property Tax Range	544.6164	360.4155	.141
Sewer Range	33.2989	74.9027	.660
1967	-278.	---	---
1968	-204.	---	---
1969	-82.	---	---
1970	xxx	---	---
(Constant)	-2340.	1313.31	.085

ANCOVA-XE

Total Population (persons)	.00287	.00072	.001
Agricultural Oppor- tunity Cost (dollars)	5.5282	2.5231	.038

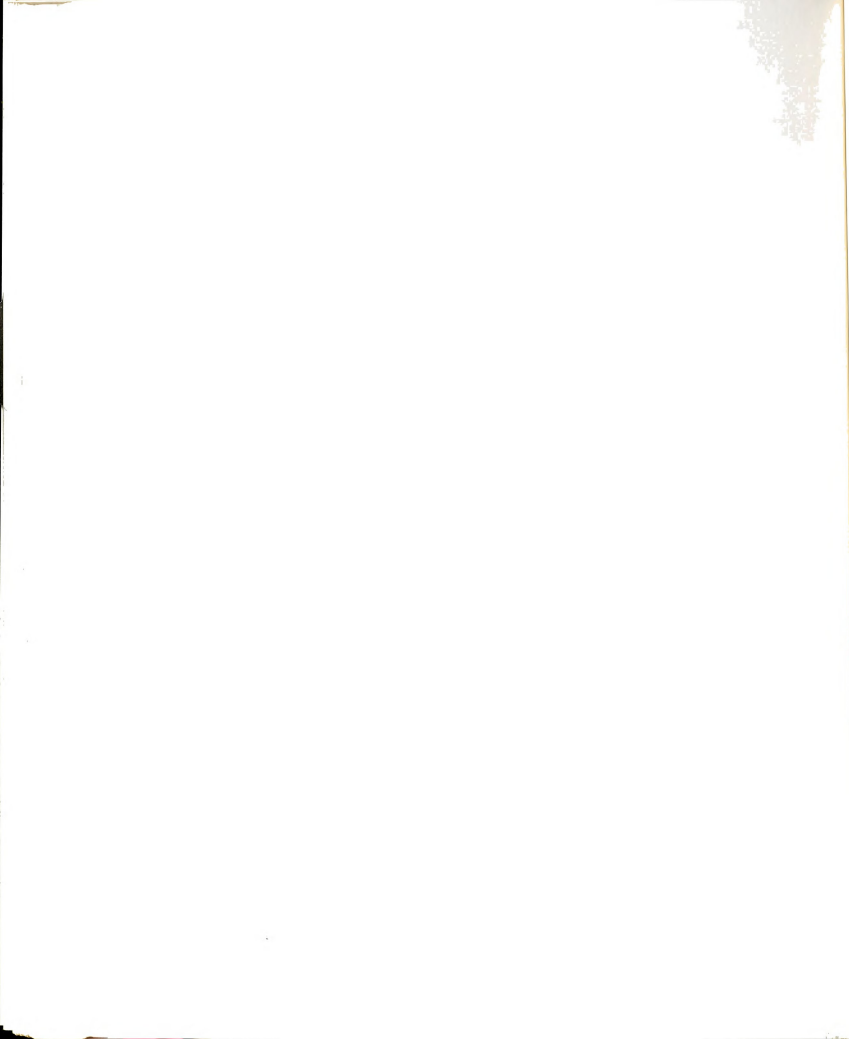


TABLE 19 (continued)

Percent New Homes			
With Public Sewer	21.8904	15.1850	.162
Property Tax Range	78.1046	401.019	.847
Sewer Range	83.6872	43.3568	.065
Los Angeles	-15842.	---	---
Detroit	-6970.	---	---
Houston	-418.	---	---
Minneapolis	-161.	---	---
Dallas	xxx	---	---
Kansas City	659.	---	---
Portland	1753.	---	---
Denver	2005.	---	---
New Orleans	2426.	---	---
Tampa	2534.	---	---
(Constant)	-4305.89	1846.20	.028

ANCOVA-TEXE

Total Population			
(persons)	.00231	.00073	.005
Agricultural Oppor-			
tunity Cost			
(dollars)	-6.200	5.179	.244
Percent New Homes			
With Public Sewer	12.1289	14.8426	.423
Property Tax Range	-22.1811	379.9817	.950
Sewer Range	24.7598	47.1966	.605
1967	-929.	---	---
1968	-778.	---	---
1969	-538.	---	---
1970	xxx	---	---
Los Angeles	-8344.	---	---
Detroit	-4627.	---	---
Houston	-468.	---	---
Dallas	xxx	---	---
Denver	471.	---	---
Kansas City	802.	---	---
Minneapolis	1222.	---	---
Tampa	2922.	---	---
Portland	3250.	---	---
New Orleans	4054.	---	---
(Constant)	623.11	2593.4	.812



TABLE 19 (continued)

Supplementary Statistics

a. Mean and Standard Deviation

	<u>Mean</u>	<u>Standard Deviation</u>
Site Price (dollars)	4077.	1645.
Total Population (persons)	2069509.	2227892.
Agricultural Opportunity Cost (dollars)	297.	119.
New Homes Sewered (percent)	92.	14.
Property Tax Range	.50	.33
Sewer Range	1.59	1.58

b. Correlation Coefficients of Dependent and Independent Variables

	<u>Site Price (\$)</u>	<u>Agricul- tural Opportunity Cost (\$)</u>	<u>Property Tax Range</u>	<u>Sewer Range</u>	<u>New Homes Sewered (%)</u>
Agricultural Oppor- tunity Cost (\$)	.73				
Property Tax Range	.42	.19			
Sewer Range	-.12	-.24	.07		
New Homes Sewered (%)	.30	-.26	.20	.06	
Total Population (persons)	.83	.59	.38	-.15	.32

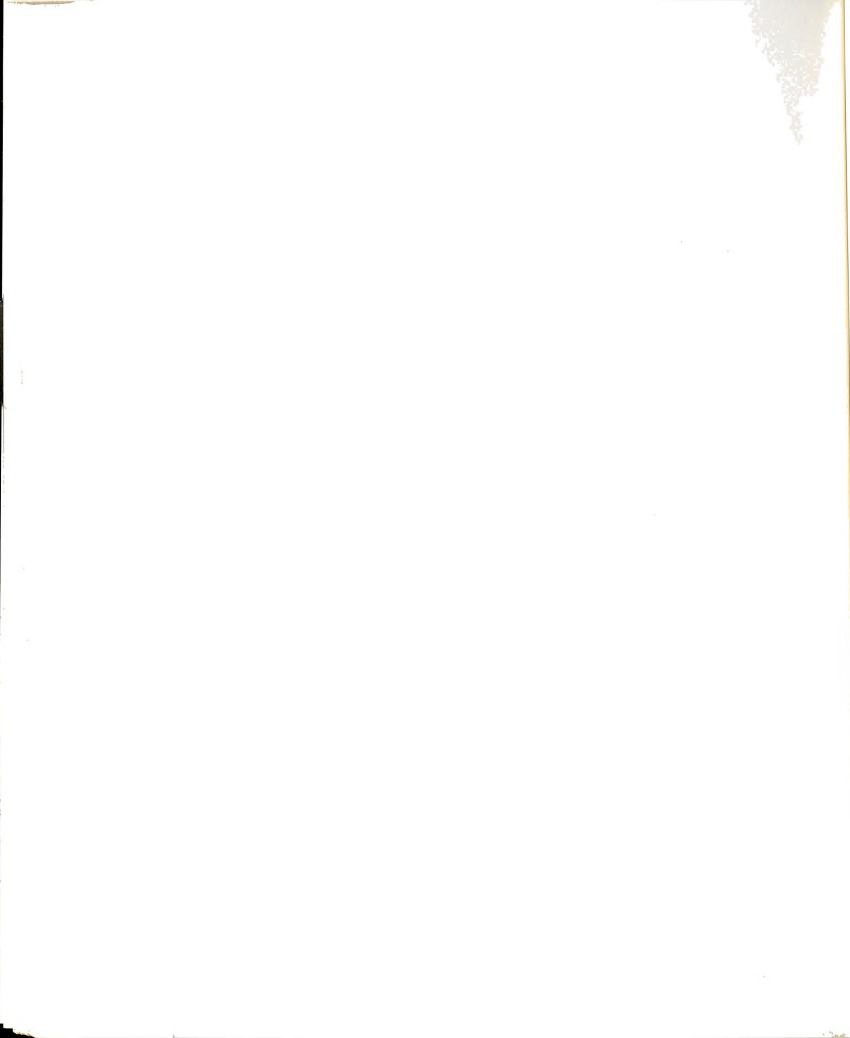
¹The dummies for either cross-sectional or time series units affect the explanatory power of the equations as a group and not individually. The selection of which city or year to be deleted affects the sign and size of the regression coefficient, therefore making the standard error and significance level meaningless, hence they are not reported.

²Property tax range is calculated by subtracting low county average per capita property tax in SMSA from high county average per capita property tax in SMSA and dividing by the overall SMSA average per capita property tax thus resulting in a relative range. Where one county consists of entire SMSA the range is zero.

³Calculated the same as the property tax range but uses the per capita sewer capital outlay high, low, and overall averages.

The ANCOVA-XE version of the covariance model added city dummies which resulted in a substantial increase in explanatory power of the equation with an R squared of .98 and an adjusted R squared of .97. While the signs of the independent variables remained unchanged the levels of significance were affected, except total population which remained essentially unchanged. Agricultural opportunity cost was significant at the .038 level, percent new homes sewerred at the .162 level and property tax range at the .847 level. The decrease in statistical significance of these three variables might indicate correlation with variables excluded from the model and picked up by the cross-sectional dummies as a group. The change in statistical significance to .065 for the sewer range is surprising and could indicate the same correlation with characteristics picked up by the city dummies. The implications of this change are not clear.

The addition of time dummies along with the city dummies for the ANCOVA-TEXE covariance model did not change the R square or adjusted R square. The F statistic test of the null hypothesis that only the city dummies (intercepts) shifted was supported. The inclusion of time dummies had marked effects on the independent variables. The significance of total population changed slightly but agricultural opportunity cost and the property tax range were significant at the .244 and .950 levels respectively, but also with negative coefficients. Percent homes with public sewer and the sewer range were significant at the .423 and .605 levels. The inclusion of the time dummies did not contribute to the explanatory power of the model but did indicate some correlation between the independent variables and short run effects that are presumed to be captured by the time dummies.



The F statistic tests of the four models indicated that the ANCOVA-XE with cross-sectional dummies added significantly to the explanatory power of the model.

Analysis of Covariance Model

Site Price Regression Results

Description of the Method

There are four sets of site price regressions reported in this section. The first set of regressions, Table 20, tested the more robust independent variables from the cross-sectional analysis (total population, agricultural opportunity cost, property tax range, and percent new homes with public sewer) for 16 cities for the years 1967-1970. In this and the following regression the OLS-pooled model was reported so that coefficients and residuals with and without city dummies could be compared. The second set of regressions, Table 21, examined a slightly different set of independent variables (total population, agriculture opportunity cost, property tax range and sewer range) because of the data available for the 1969-1973 time period. The third set of regressions, Table 22, examined the same model but for fewer cities over a longer period of time (ten cities for eleven years). This set of equations also re-introduces the ANCOVA-TE and ANCOVA-TEXE models. This was done to re-examine the role of time dummies when a substantial number of years is involved.

The fourth set of site price regressions, Table 23, examines a substantially different set of independent variables which includes agricultural opportunity cost, site size, and development cost. This

TABLE 20

SITE PRICE POOLED REGRESSIONS 1967-1970

17 Cities, 4 YEARS: 68 CASES

Model	OLS-Pooled	ANCOVA-XE
R Squared	.54	.95
Adjusted R Squared	.54	.94
Desidual Sum of Squares	36350512.	3575705.

Model/Independent Variables	Regression Coefficients	Standard Error ¹	Significance ¹
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OLS-Pooled

Total Population (persons)	.000063	.000031	.051
Agricultural Oppor- tunity Cost (dollars)	6.7889	.8495	≤ .0001
Property Tax Range ²	-341.33	312.09	.278
Percent New Homes with Public Sewers (Constant)	2.2451 1533.	4.4770 543.	.618 .006

ANCOVA-XE

Total Population (persons)	.00208	.00064	.002
Agricultural Oppor- tunity Cost (dollars)	4.1927	1.2190	.001
Property Tax Range	-248.10	216.38	.257
Percent New Homes with Public Sewers	5.8961	4.4700	.194
New York	-29693.	---	---
Chicago	-12224.	---	---
Detroit	-6217.	---	---
Philadelphia	-5872.	---	---
San Francisco	-2234.	---	---
Baltimore	-1972.	---	---

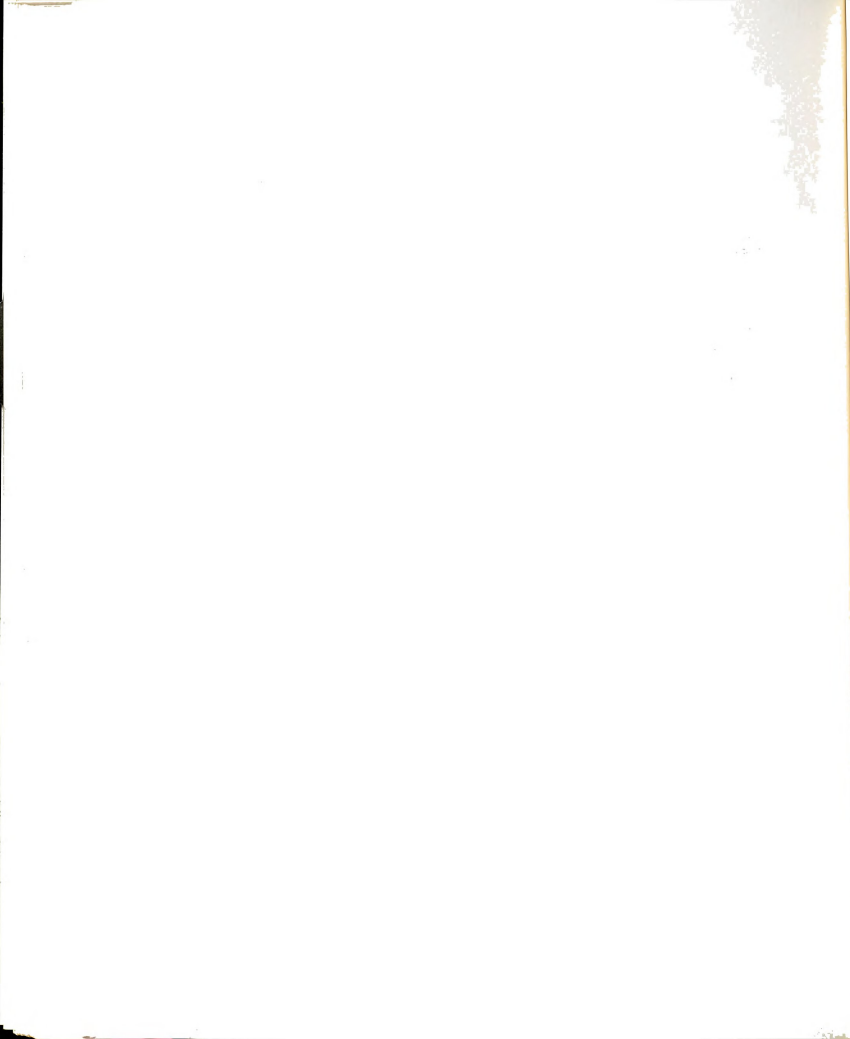


TABLE 20 (continued)

Pittsburgh	-1655.	---	---
Indianapolis	-906.	---	---
Atlanta	-658.	---	---
Cincinnati	-194.	---	---
San Antonio	-135.	---	---
Miami	-50.	---	---
Seattle	XXX	---	---
Louisville	399.	---	---
Dayton	728.	---	---
San Diego	1004.	---	---
San Bernardino	1664.	---	---
(Constant)	105.	635.	.869

¹The dummies for either cross-sectional or time series units affect the explanatory power of the equation as a group and not individually. The selection of which city or year to be deleted affects the sign and size of the regression coefficient, therefore making the standard error and significance level meaningless, hence they are not reported.

²Property tax range is calculated by subtracting low county average per capita property tax in SMSA from high county average per capita property tax in SMSA and dividing by the overall SMSA average per capita property tax this resulting in a relative range. Where one county consists of entire SMSA the range is zero.

TABLE 21

SITE PRICE POOLED REGRESSIONS RESULTS, 1969-1973

21 CITIES, 5 YEARS: 105 CASES

Model	OLS-Pooled	ANCOVA-XE
R Squared	.39	.85
Adjusted R Squared	.37	.80
Residual Sum of Squares	24360748.	98851269.

Model/Independent Variables	Regression Coefficients	Standard Error ¹	Significance ¹
--------------------------------	----------------------------	-----------------------------	---------------------------

OLS-Pooled

Total Population (persons)	.00010	.00006	.134
Agricultural Oppor- tunity Cost (dollars)	4.5688	.64840	≤ .0001
Property Tax Range ²	-274.8154	342.879	.425
Sewer Range ³	.3950	.5196	.449
(Constant)	2096.	370.	≤ .0001

ANCOVA-XE

Total Population (persons)	.002081	.001974	.295
Agricultural Oppor- tunity Cost (dollars)	1.3377	1.034	.200
Property Tax Range	-103.8401	506.3349	.838
Sewer Range	-.1812	.3161	.568
Chicago	-13034.	---	---
Philadelphia	-6681.	---	---
St. Louis	-3179.	---	---
Washington, D.C.	-2702.	---	---
San Francisco	-2702.	---	---
Birmingham	-1831.	---	---
Baltimore	-1814.	---	---
Omaha	-1231.	---	---
Oklahoma City	-1097.	---	---
Miami	-843.	---	---
Seattle	-815.	---	---
Louisville	-618.	---	---

TABLE 21 (continued)

Salt Lake City	-337.	---	---
Wilmington	xxx	---	---
Dayton	50.	---	---
Albany	120.	---	---
Greensboro	135.	---	---
Sacramento	206.	---	---
Richmond	373.	---	---
San Diego	492.	---	---
San Bernardino	1359.	---	---
(Constant)	2392.	753.	.002

¹The dummies for either cross-sectional or time series units affect the explanatory power of the equation as a group and not individually. The selection of which city or year to be deleted affects the sign and size of the regression coefficient, therefore making the standard error and significance level meaningless, hence they are not reported.

²Property tax range is calculated by subtracting low county average per capita property tax in SMSA from high county average per capita property tax in SMSA and dividing by the overall SMSA average per capita property tax this resulting in a relative range. Where one county consists of entire SMSA the range is zero.

³Calculated the same as the property tax range but uses the per capita sewer capital outlay high, low, and overall averages.

TABLE 22

SITE PRICE POOLED REGRESSIONS, 1964-1974

TEN CITIES FOR ELEVEN YEARS: 110 CASES

Model	OLS-Pooled	ANGOVA-TE	ANGOVA-XE	ANGOVA-TEXE
R Square	.36	.40	.60	.65
Adjusted R Square	.33	.31	.56	.56
Residual Sum of Squares	148210116.	139243600.	90910647.	80254036.

Model/Independent Variables	Regression Coefficients	Standard Error ¹	Significance ¹
--------------------------------	----------------------------	-----------------------------	---------------------------

OLS-Pooled

Total Population (persons)	-.00015	.00006	.020
Agricultural Oppor- tunity Cost (dollars)	5.245	.691	≤ .0001
Property Tax Range ²	-11.636	346.45	.973
Sewer Range ³	-.159	.623	.800
(Constant)	2428.	412.	≤ .0001

ANGOVA-TE

Total Population (persons)	-.00015	.00006	.018
Agricultural Oppor- tunity Cost (dollars)	5.797	1.064	≤ .0001
Property Tax Range	54.492	363.479	.881
Sewer Range	-.266	.744	.721
1964	345.	---	---
1965	443.	---	---
1966	584.	---	---
1967	833.	---	---
1968	1016.	---	---
1969	1066.	---	---
1970	919.	---	---
1971	705.	---	---
1972	597.	---	---
1973	560.	---	---
1974	xxx	---	---
(Constant)	1510.	902.	.097

TABLE 22 (continued)

<u>ANCOVA-XE</u>			
Total Population (persons)	-.00076	.0013	.588
Agricultural Oppor- tunity Cost (dollars)	5.569	1.366	≤ .0001
Property Tax Range	-1106.39	636.13	.085
Sewer Range	-.218	.522	.677
San Bernardino	-1447.	---	---
Dayton	-955.	---	---
Baltimore	-731.	---	---
Louisville	-433.	---	---
Seattle	xxx	---	---
Miami	531.	---	---
San Diego	1273.	---	---
San Francisco	2171.	---	---
Philadelphia	2189.	---	---
Chicago	2514.	---	---
(Constant)	3641.	1353.	.008

<u>ANCOVA-TEXE</u>			
Total Population (persons)	-.0031	.0016	.056
Agricultural Oppor- tunity Cost (dollars)	6.843	3.173	.034
Property Tax Range	-1032.	661.	.122
Sewer Range	-.396	.611	.519
1964	--368.	---	---
1965	-226.	---	---
1966	6.	---	---
1967	347.	---	---
1968	649.	---	---
1969	728.	---	---
1970	743.	---	---
1971	545.	---	---
1972	426.	---	---
1973	388.	---	---
1974	xxx	---	---
San Bernardino	-3245.	---	---
Dayton	-2365.	---	---
Louisville	-1553.	---	---
Baltimore	-192.	---	---
Seattle	xxx	---	---
Miami	372.	---	---
San Diego	826.	---	---

TABLE 22 (continued)

San Francisco	5911.	---	---
Philadelphia	8661.	---	---
Chicago	14979.	---	---
(Constant)	5728.	2648.	.033

¹The dummies for either cross-sectional or time series units affect the explanatory power of the equation as a group and not individually. The selection of which city or year to be deleted affects the sign and size of the regression coefficient, therefore making the standard error and significance level meaningless, hence they are not reported.

²Property tax range is calculated by subtracting low county average per capita property tax in SMSA from high county average per capita property tax in SMSA and dividing by the overall SMSA average per capita property tax this resulting in a relative range. Where one county consists of entire SMSA the range is zero.

³Calculated the same as the property tax range but uses the per capita sewer capital outlay high, low, and overall averages.

TABLE 23

SITE PRICE POOLED REGRESSIONS, 1967-1974

43 CITIES, 8 YEARS: 344 CASES

Model	OLS-Pooled	ANCOVA-XE	ANCOVA-TEXE
R Squared	.28	.86	.87
Adjusted R Squared	.27	.84	.85
Residual Sum of Squares	752157836.	146217715.	134119587.

Model/Independent Variables	Regression Coefficients	Standard Error ¹	Significant ¹
--------------------------------	----------------------------	-----------------------------	--------------------------

OLS-Pooled

Agricultural Oppor-

tunity Cost (dollars)	2.8470	.6570	≤ .0001
Site Size (sq.ft.)	.7843	.1708	≤ .0001
Development Cost (dollars)	.0532	.0282	.060
(Constant)	446.	493.	.366

ANCOVA-XE

Agricultural Oppor-

tunity Cost (dollars)	5.7314	.9337	≤ .0001
Site Size (sq.ft.)	.3090	.0206	≤ .0001
Development Cost (dollars)	.0270	.2133	.899
Knoxville	-1386.	---	---
Charlotte	-1909.	---	---
Spokane	-1753.	---	---
Raleigh	-1667.	---	---
Greensboro	-1608.	---	---
Pensacola	-1455.	---	---
Nashville	-1385.	---	---
St. Louis	-900.	---	---
Shreveport	-796.	---	---
Richmond	-612.	---	---
Jacksonville	-552.	---	---
Little Rock	-498.	---	---
Tacoma	-411.	---	---
Orlando	-333.	---	---
Montgomery	-330.	---	---
Memphis	-245.	---	---
Fresno	-232.	---	---

TABLE 23 (continued)

Chicago	-193.	---	---
Lubbock	-56.	---	---
Oklahoma City	-38.	---	---
Washington, D.C.	xxx	---	---
Stockton	37.	---	---
Dayton	79.	---	---
Columbus	248.	---	---
Fort Worth	289.	---	---
Tulsa	293.	---	---
Louisville	431.	---	---
Sacramento	456.	---	---
El Paso	497.	---	---
Salt Lake City	615.	---	---
Baltimore	899.	---	---
Miami	1009.	---	---
Philadelphia	1036.	---	---
Seattle	1124.	---	---
Vallejo	1417.	---	---
Albuquerque	1587.	---	---
San Diego	2160.	---	---
Phoenix	2275.	---	---
Oxnard	2520.	---	---
San Jose	3011.	---	---
San Francisco	3064.	---	---
Las Vegas	3467.	---	---
Anaheim	6273.	---	---
(Constant)	-1551.	412.	.0001

ANCOVA-TEXE

Agricultural Oppor-
tunity Cost

(dollars)	3.4717	1.0632	.001
Site Size (sq.ft.)	.3317	.0210	≤ .0001

Development Cost

(dollars)	-1.388	.3736	≤ .0001
-----------	--------	-------	---------

1967	-2762.	---	---
1968	-2594.	---	---
1969	-2200.	---	---
1970	-1751.	---	---
1971	-1547.	---	---
1972	-1089.	---	---
1973	-612.	---	---
1974	xxx	---	---
Knoxville	-3218.	---	---
Charlotte	-1968.	---	---
Nashville	-1897.	---	---
Raleigh	-1705.	---	---

TABLE 23 (continued)

Greensboro	-1615.	---	---
Pensacola	-1503.	---	---
Shreveport	-1366.	---	---
Little Rock	-1178.	---	---
Montgomery	-971.	---	---
Lubbock	-967.	---	---
Oklahoma City	-918.	---	---
Fort Worth	-696.	---	---
Memphis	-670.	---	---
Richmond	-646.	---	---
Tulsa	-595.	---	---
Jacksonville	-575.	---	---
El Paso	-457.	---	---
Spokane	-433.	---	---
Orlando	-367.	---	---
St. Louis	-92.	---	---
Louisville	-38.	---	---
Washington, D.C.	xxx	---	---
Salt Lake City	469.	---	---
Miami	1003.	---	---
Tacoma	1011.	---	---
Dayton	1030.	---	---
Chicago	1061.	---	---
Albuquerque	1159.	---	---
Columbus	1240.	---	---
Baltimore	1374.	---	---
Philadelphia	1672.	---	---
Fresno	1738.	---	---
Phoenix	2009.	---	---
Stockton	2023.	---	---
Sacramento	2425.	---	---
Seattle	2497.	---	---
Las Vegas	3379.	---	---
Vallejo	3406.	---	---
San Diego	4132.	---	---
Oxnard	4504.	---	---
San Jose	5018.	---	---
San Francisco	5068.	---	---
Anaheim	8296.	---	---
(Constant)	3840.	1240.	.002

¹ The dummies for either cross-sectional or time series units affect the explanatory power of the equation as a group and not individually. The selection of which city or year to be deleted affects the sign and size of the regression coefficient, therefore making the standard error and significance level meaningless, hence they are not reported

equation also looks at a period greater than in the initial analysis (eight years) but examines some variables used in the previous research by Witte (1975) where time dummies were more successful. The availability of a much larger number of cities, forty three, also encouraged examination of these variables.

Several features of the analysis of covariance model show up on the tables for the site price pooled regressions. The dummies for either the cross-sectional or time series units affect the explanatory power of the equation as a group and not individually. The selection of which city or year to be deleted affects the sign and size of the regression coefficient, therefore making the standard error and significance level meaningless. However, the array or relationship of the cities or years is not affected by the choice of deleted observation.

Interpreting the Results

The four site price regressions, which apply the more or less same theoretical model, include the test of the covariance model, Table 19 and the first three tables in this section, Tables 20, 21, and 22. While the model tested varies slightly across the four sets of equations, several general comments can be made from this series of equations.

The explanatory power of the model seems inversely related to the number of cities and years or, in other words, the number of cases. This is summarized in Table 24.

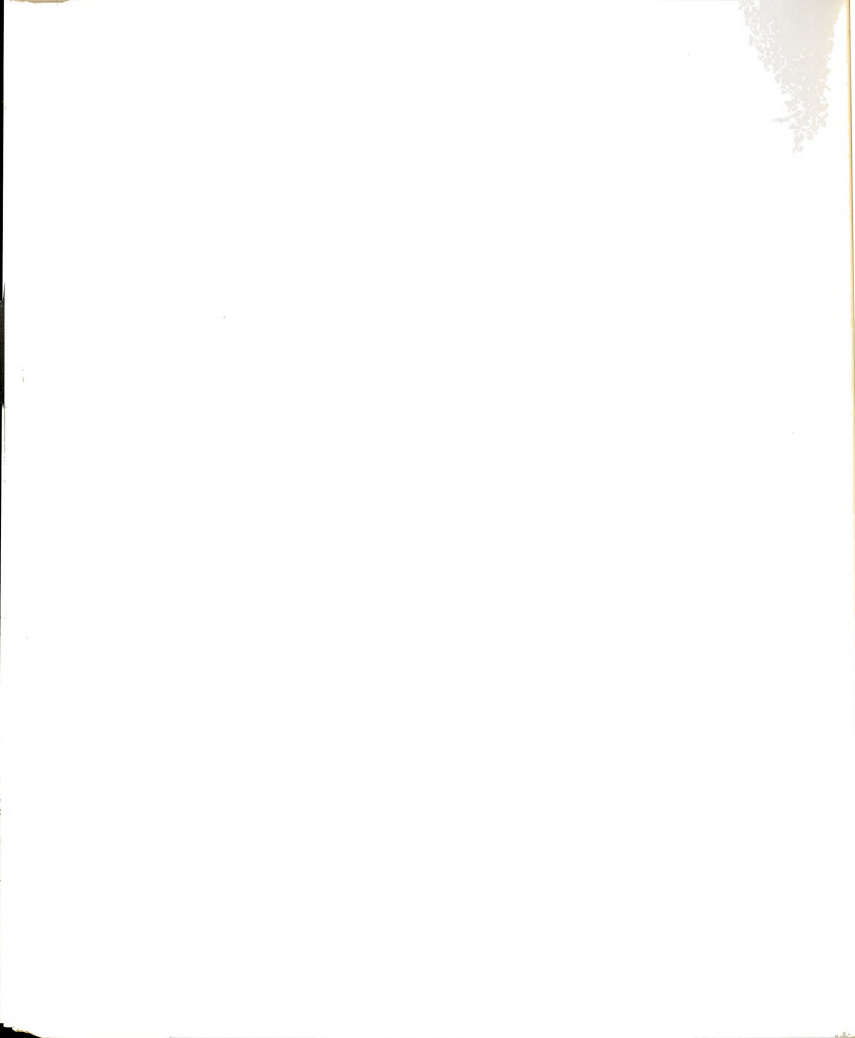
TABLE 24

Summary of R^2 & $\bar{R}^2$ for Tables 19, 20, 21, 22
for OLS-Pooled and ANCOVA-XE Models

Table	OLS-Pooled $R^2 - \bar{R}^2$	ANCOVA-XE $R^2 - \bar{R}^2$	Cities x Years = Cases
19	.86-.84	.98-.97	10 x 4 = 40
20	.54-.54	.95-.94	17 x 4 = 68
21	.39-.37	.85-.80	21 x 5 = 105
22	.36-.33	.60-.56	10 x 11 = 110

Source: See Tables 19, 21, 21 and 22.

The test of the covariance model, had the greatest overall success as judged by the high R squared. The ten cities for four years then changes in Table 20 to seventeen cities for the same four year period with the only difference being the deletion of the sewer range variable. The explanatory power, R squared, of the Table 20 regressions is .54 for the OLS-pooled and .95 for the ANCOVA-XE. The cities for each of Tables 19 and 20 are completely different. This might account for some of the differences in explanatory power. The decline in explanatory power continues in Table 21 with 21 cities for 5 years with an R squared of .39 for the OLS-pooled and .60 for the ANCOVA-XE regressions. The reason for this is not readily apparent. The increase in the number of observations should increase the variability and hence increase the R squared. However, the combination of the different samples represented by Tables 20, 21, and 22 and the increase in the number of years along with the lack of importance of years as



represented by the F test on the time dummies might account for the change. The other conclusion is that the theoretical cross-sectional model is not very successful when time is introduced.

The site price pooled regressions presented in Tables 20, 21, and 22 are used to examine, in part, the effect of city dummies as a group upon the independent variables in the model. The following section reviews the results of the regressions in Tables 19, 20, 21, and 22 on the independent variables. Data manipulation is also discussed where appropriate.

Total population for each of the urbanized areas is available for 1960 and 1970 from the Census of Population. Data for other years were either interpolated or extrapolated linearly. The total population variable was significant in the regressions in Table 19 and Table 20. In these regressions the inclusion of city dummies in the ANCOVA-XE models generally increased the significance of the total population variable. However, the regressions in Table 21 and Table 22 show either a diminished significance level in general or, as in the case of Table 22, a negative sign. The changes in the significance levels resulting from the inclusion of city dummies or time dummies could mean that the variable, in this case total population, is multicollinear with variables not in the model but which are picked up by the dummies. Also, the increase in the number of observations and the decrease in explanatory power of each set of equations indicates, perhaps, different variable coefficients over time than among cities. The small contribution of time dummies to the explanatory power of the regression equation throughout supports the notion that in this

particular model time dummies pick up short run fluctuations while the city dummies capture longer run trends.

Agricultural opportunity cost remains essentially significant in all of the equations. There was a change from $\leq .0001$ significance to .038 in the covariance model test and from $\leq .0001$ to .200 in Table 21. This may, as with total population, indicate multicollinearity with an excluded variable. However, no clear pattern of such exists. Agricultural opportunity cost remains robust across cities and time.

Both the property tax range and the sewer range yielded disappointing results. For the property tax range, only the ANCOVA-XE and ANCOVA-TEXE models in Table 22 demonstrated any promise. The level of significance was .085 and .122 respectively. One possible interpretation is that once factors which are associated with the property tax range are captured by the inclusion of city dummies (when a larger number of years is involved), then the property tax range becomes significant. However, the signs in Table 22 are negative for the property tax range which also raises questions about the behavior of the variable over time and across cities.

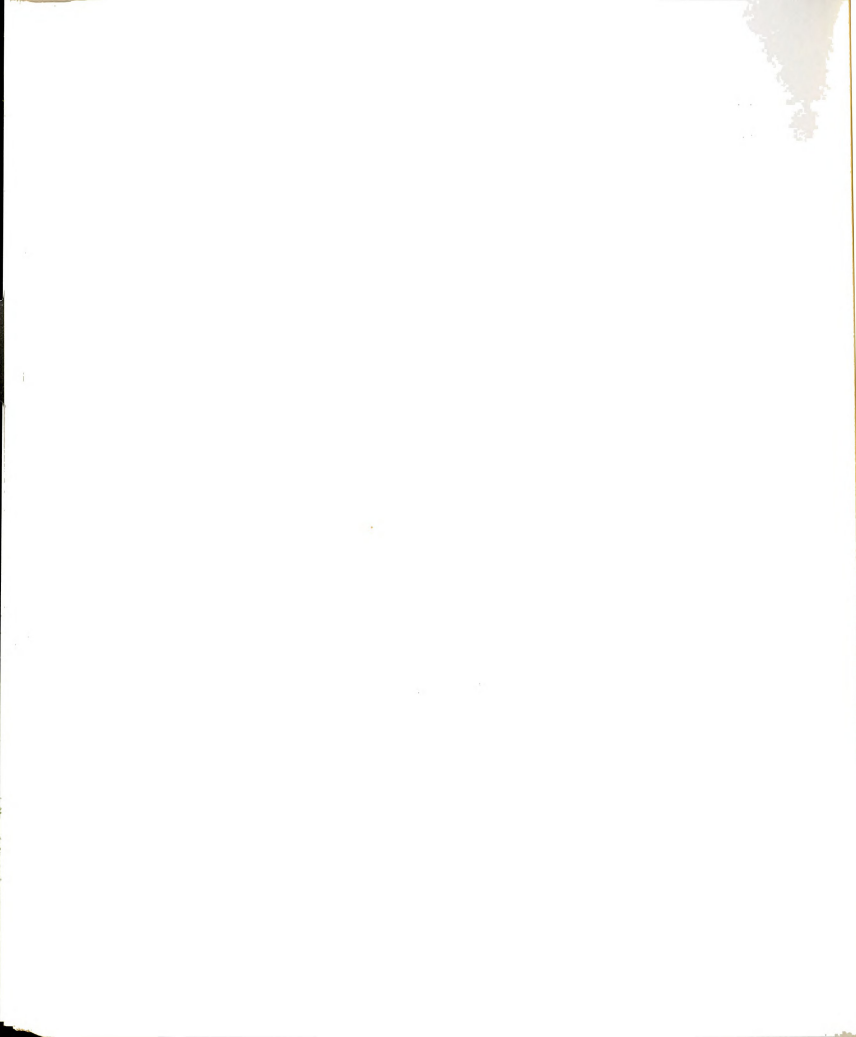
The sewer range with one exception proved as statistically insignificant in the pooled regressions as it was in the cross-sectional analysis. In Table 19, the ANCOVA-XE regression the sewer range was significant at the .065 level. None of the conceivable explanations for this result would lend encouragement to the use of this specification of the sewer range.

The percent new homes with public sewer was significant at the .167 level in the ANCOVA-XE regression in Table 19 and .194 for the same model in Table 20. The represents changes from $\leq .0001$ level of

significance in Table 19 OLS-pooled model and .618 level of significance for the Table 20 OLS-pooled model. Tables 19 and 20 represent different samples and could, through some unknown bias, cause these results. However, these results do raise suspicions about the reliability and validity of this specification for sewer supply.

Table 23 is the final site price pooled regression set and is the result of the preceding analysis and part of the model proposed by Witte (1975). The 344 cases consists of 43 cities for 8 years. The site size variable was suggested by Witte. The agricultural opportunity cost variable was retained because of its robustness. Development cost in this context has been adjusted for years preceeding and following 1969 by the Boeckh index of construction costs. Other variables such as the property tax range and sewer range were not used because of the limited number of cities for which they existed and the impression that further analysis would not have increased the understanding of their effectiveness in the model.

The results of the three equations do not follow all of the a priori expectations. The OLS-pooled model without dummies had an R^2 of .28. This jumped to an R^2 of .85 for the ANCOVA-XE regression with 42 city dummies added. The null hypothesis that the two equations were equal was rejected by the F test. This confirms the previous work in the Test of the Covariance model. Therefore, city dummies did add to the explanatory power of the equation when degrees of freedom are taken into account. When time dummies were added the explanatory power increased slightly but the F test indicated that the increase in explanatory power was offset by the loss of degrees of freedom by the addition of the time dummies. Agricultural opportunity cost and site



size remained consistently significant across the three equations. The construction cost index version of development cost decreased from a significance level of .060 to a significance level of .899 when city dummies were added. The significance level then became $\leq .0001$ with a negative sign when time dummies were added. The reasons for this are not clear. Basically, over these variables the inclusion of time dummies does not aid the explanatory power of the model. Retrospectively this is not surprising since short run variables would not seem likely to have that much of an influence on these three variables.

The results of the site price pooled regressions were used to develop appreciation pooled regression tested below. There was greater flexibility with the site price data because of the greater amount of raw data available.

Appreciation Model

Description of the Method

Appreciation was used as the dependent variable in a pooled regression framework for the period 1967 to 1970. One of the variables used to calculate appreciation is development cost. This variable was extrapolated from 1969 by use of the Boeckh index of residential construction costs and was less reliable the further away from 1969. Agricultural opportunity costs were interpolated between 1964, 1969, and 1974 and could be considered as reasonably accurate. However, the practical necessity of extrapolating or interpolating the variable used to calculate appreciation in addition to some of the observations of site size reduced the confidence in the dependent

variable. The independent variables were total population, percent new homes with public sewers, property tax range, and the sewer range. The data base consisted of 25 cities over a 4 year period or 100 cases. No other equations were attempted given the aforementioned concerns with the dependent variable calculation. However, a full series of the OLS-pooled and the various forms of the covariance model were tested.

Interpreting the Results

The results of the appreciation pooled regressions are reported in Table 25. The results of the OLS-pooled was an R^2 of .13. The ANCOVA-TE did not improve the statistical model but the ANCOVA-XE led to a .95 R squared. This might indicate a greater role for unspecified city related variables whose effect is captured by the city dummies. The ANCOVA-TEXE improved the explanatory power slightly. Surprisingly, while the effect of the addition of time dummies on the OLS-pooled results in terms of the statistical significance of the variables was negligible, the addition of time dummies to the ANCOVA-XE model changed total population from a .224 to a .001 level of significance, percent new homes with public sewer from a .169 to a .050 level of significance, the property tax range from a .071 to a .028 level of significance, and the sewer range from a .170 to a .024 level of significance. These changes could indicate a greater role of short term fluctuations on appreciation than is the case with site price.

While the appreciation results are not spectacular, they are encouraging and the consistency of the results with the

TABLE 25

APPRECIATION COVARIANCE MODEL, 1967-1970

25 CITIES, 4 YEARS: 100 CASES

Model	OLS-Pooled	ANCOVA-TE	ANCOVA-XE	ANCOVA-TEXE
R Squared	.14	.14	.95	.96
Adjusted R Squared	.10	.07	.93	.94
Residual Sum of Squares	52884250.	52683652.	3170971.	2624613.

Model/Independent Variables	Regression Coefficients	Standard Error ¹	Significance ¹
--------------------------------	----------------------------	-----------------------------	---------------------------

OLS-Pooled

Total Population	.000068	.000028	.017
Percent New Houses			
Sewered	11.596	3.548	.001
Property Tax Range ²	182.237	234.842	.440
Sewer Range ³	50.370	48.267	.299
(Constant)	178.	374.	.635

ANCOVA-TE

Total Population	.000068	.000028	.018
Percent New Houses			
Sewered	11.748	3.609	.002
Property Tax Range	174.37	238.82	.467
Sewer Range	51.0835	48.9389	.299
1967	116.	---	---
1968	51.	---	---
1969	21.	---	---
1970	xxx	---	---
(Constant)	120.	408.	.770

ANCOVA-XE

Total Population	.000357	.000291	.224
Percent New Houses			
Sewered	4.062	2.921	.169
Property Tax Range	-245.484	134.143	.071
Sewer Range	27.58	19.914	.170
New York	-4343.	---	---
Chicago	-2301.	---	---
Detroit	-1104.	---	---
Los Angeles	-932.	---	---
Indianapolis	-728.	---	---

TABLE 25 (continued)

Philadelphia	-660.	---	---
Portland	-612.	---	---
Baltimore	-421.	---	---
Spokane	-282.	---	---
Kansas City	-188.	---	---
San Francisco	-76.	---	---
Pittsburgh	-21.	---	---
Seattle	xxx	---	---
Dayton	126.	---	---
Atlanta	183.	---	---
Minneapolis	240.	---	---
San Bernardino	257.	---	---
San Diego	423.	---	---
San Antonio	523.	---	---
Louisville	578.	---	---
Miami	652.	---	---
Dallas	672.	---	---
Houston	863.	---	---
New Orleans	1327.	---	---
Denver	2737.	---	---
(Constant)	521.	404.	.201

ANCOVA-TEXE

Total Population	.0012	.0003	.001
Percent New Houses			
Sewered	5.489	2.750	.050
Property Tax Range	-281.46	125.65	.028
Sewer Range	43.70	18.98	.024
1967	252.	---	---
1968	141.	---	---
1969	42.	---	---
1970	xxx	---	---
New York	-17265.	---	---
Chicago	-7081.	---	---
Los Angeles	-7005.	---	---
Detroit	-3556.	---	---
Philadelphia	-3177.	---	---
San Francisco	-1652.	---	---
Baltimore	-831.	---	---
Pittsburgh	-668.	---	---
Indianapolis	-429.	---	---
Portland	-289.	---	---
Minneapolis	-249.	---	---
Kansas City	-169.	---	---
Seattle	xxx	---	---
Atlanta	196.	---	---
Spokane	402.	---	---



TABLE 25 (continued)

San Diego	415.	---	---
Houston	454.	---	---
Dallas	486.	---	---
Dayton	504.	---	---
Miami	693.	---	---
San Bernardino	769.	---	---
San Antonio	853.	---	---
Louisville	1014.	---	---
New Orleans	1481.	---	---
Denver	2807.	---	---
(Constant)	-702.	504.	.168

¹The dummies for either cross-sectional or time series units affect the explanatory power of the equation as a group and not individually. The selection of which city or year to be deleted affects the sign and size of the regression coefficient, therefore making the standard error and significance level meaningless, hence they are not reported.

²Property tax range is calculated by subtracting low county average per capita property tax in SMSA from high county average per capita property tax in SMSA and dividing by the overall SMSA average per capita property tax this resulting in a relative range. Where one county consists of entire SMSA the range is zero.

³Calculated the same as the property tax range but uses the per capita sewer capital outlay high, low, and overall averages.

cross-sectional analysis and the contrasting results with site price should also encourage further analysis and a finer definition of the variables and specification of the model.

Speculative Analysis of City and Time Dummy Arrays

As mentioned earlier the array of the regression coefficients for cities and time dummies can indicate a relative association between the cities or the years. While the reader is encouraged to speculate or develop further analytical methods, some of the more obvious trends will be indicated here.

Cities seem to be grouped in several complementary ways. Older industrial cities tend to group separately from newer cities. Northeast and North Central cities separate from Southern and Californian cities. Many of these characteristics were captured in the cross-sectional analysis by percent change in population and mean family income. These variables were not pursued in the pooled regression analysis because of the excessive extrapolation and interpolation required and the concomitant effect on the available degrees of freedom. However, other variables are also suggested by such an array. Regional variations in supply variables, including instrumental variables, occur in addition to demand variables. For example, the literature indicates that the South is less stringent in its zoning and public service provision administration (Delafons, 1969). The industrial base could also account for the grouping. There are obviously many interrelated factors which challenge and call for better variable definition and model specification.

The array of time dummy coefficients can also be suggestive. Figure 4 plots the regression coefficients from Table 22 and the mortgage rates for the same years. The comparison suggests an association which theory and Witte's (1975) earlier work also support. The apparent lag suggests that the time dummy regression coefficients serve as a leading variable, suggesting that site price serves as a leading variable for the mortgage rate. Developers, indeed, could be expected to buy land in advance of housing demand which is closely linked to mortgage rate adjustments.

It is also interesting to note that while the time dummy coefficients follow the same trend in the Table 19 the significantly different model represented in Table 23 (agricultural opportunity cost, site size, and development cost) indicates a constantly increasing slope. This might indicate trends similar to the various price indices.

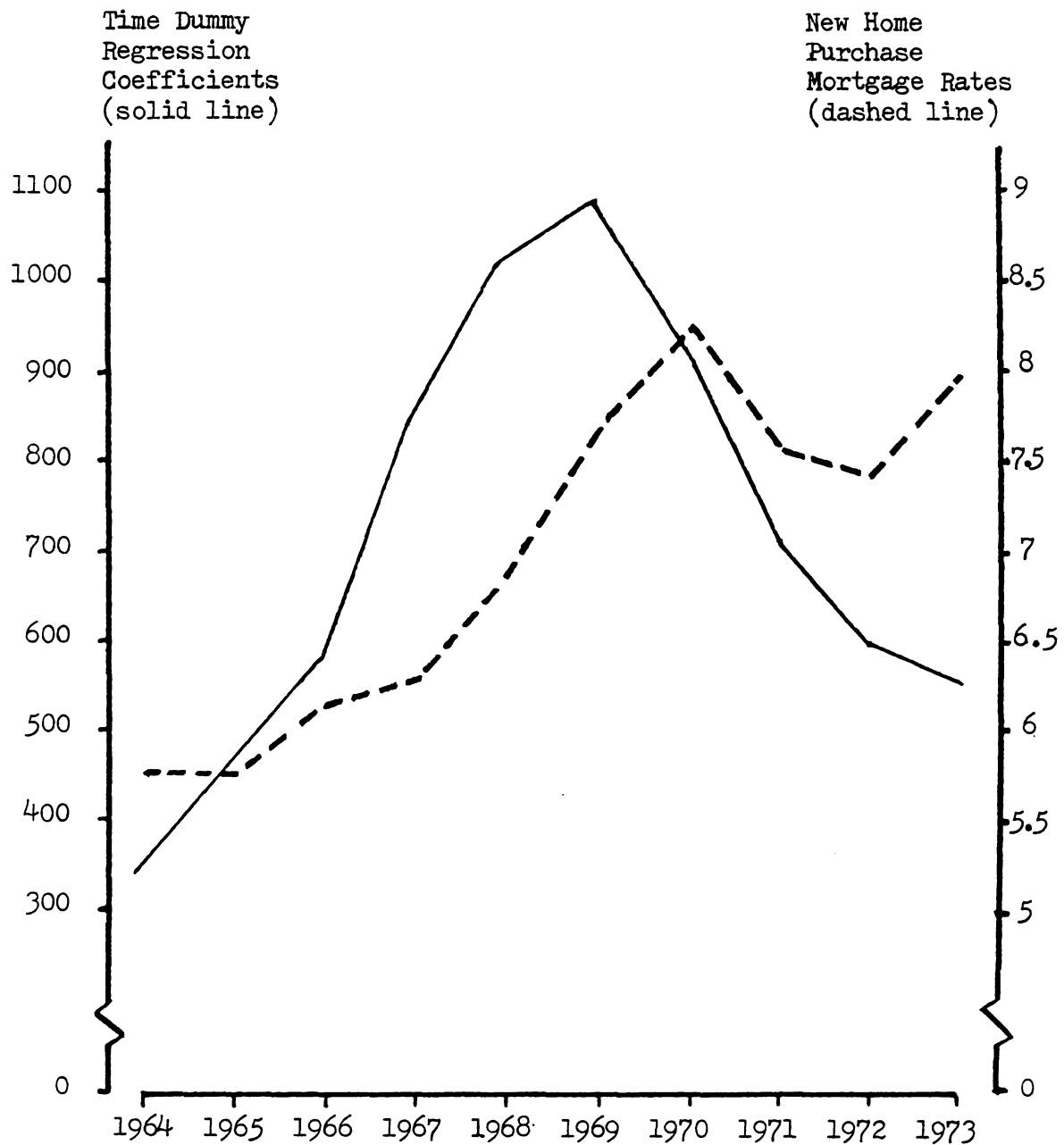
Brief Summary and Conclusion of Pooled Regression Analysis

The results of the pooled cross-sectional, time series regressions presented here are promising, informative but not without some significant problems.

Regressions by Witte (1975) and econometric suggestions by Pindyck and Rubinfeld (1976) led to the development and pretesting of a covariance model which included city dummies which allowed the cross-sectional intercepts to shift. Estimating each of the subsequent regressions with and without city dummies and examining the residuals indicated no pattern of excluded variables. Appreciation results as contrasted with site price were weak and point to several measurement problems in the calculation of appreciation over time.



FIGURE 4. COMPARISON OF TIME DUMMY REGRESSION COEFFICIENTS AND NEW HOME PURCHASE MORTGAGE RATES, 1964-1973.



Sources: Time Dummy Regression Coefficients are in Table 22, ANCOVA-TE Model, Mortgage Rates are in Current Business Statistics, 1975.

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The covariance model with city dummies increased the explanatory power of the regression model. It provided, in addition, a better perspective of the econometric issues in cross-sectional analysis by indicating to some extent the degree of multicollinearity of total population, agricultural opportunity cost and percent new homes with public sewers. The small contribution of time to the model is not uncommon in this kind of research. Time in this context is short run, i.e., mortgage rates. The pooled cross-sectional time series approach, however, could be further expanded in variable specification so that the theory would indicate that different things are happening over time and between cities. Some additional information may be gained when cities are grouped by size of coefficient or ranked to indicate if there is any pattern in city groupings.

The systematic analysis of cities and time for site price and appreciation as represented by the covariance model is essentially the first such attempt. Witte's (1975) model was cursory, at least in its presentation. The model here examined more variables over a generally greater number of years and raised more issues and problems.



CHAPTER VII

CONCLUSIONS AND IMPLICATIONS OF THE ECONOMETRIC ANALYSIS

Introduction

Preliminary conclusions and interpretations of the econometric analysis using aggregate data will help to highlight the following chapter, which uses a finer focus in comparing the variables of interest in a comparative case study of Lansing, Kalamazoo, and Jackson, Michigan. This chapter will sequentially review the geographical unit of analysis and the independent variables, especially the policy implications of the instrumental variables.

Geographic Definition Issues

This research used urbanized area data for total population, percent change in population and income. SMSA data was used for site price, site size, percent new and all homes with public sewers, property tax range, sewer range, and the property tax proportion of general revenue. Regional data was used for development cost and selected county average data was used for agricultural opportunity cost. The NAHB site price and raw land data was probably close to the SMSA geographical unit. This represents the best available data.

The SMSA basis for the FHA form of site price and appreciation and the essentially SMSA basis for the NAHB form of site price and appreciation do have the potential for including land not relevant to the land conversion market. It is not clear whether this land and



associated site prices or appreciation would be greater or less on the average than the land of interest. Sites could be larger and development costs could be less due to fewer requirements. Or the sites could have amenity values. If the sites and associated housing prices were greater, then the NAHB data would be more likely to be affected rather than the generally lower priced FHA homes. The net effect of the SMSA geographical unit in defining the dependent variables is uncertain, depending upon the character of the outlying areas. These areas could range from extremely rural areas with scattered strip development to small or medium satellite cities. The same difficulties exist for the independent variables based upon the SMSA definition. Site size came from the same FHA data base and, as in the case of site price, is not overly affected by the generally large geographic area because the FHA homes are on lower priced lots, perhaps concentrated closer to the center of the metropolitan area.

The instrumental variables were also based upon SMSA data. Percent all homes with public sewer might have been somewhat underestimated by the inclusion of large areas where, depending upon local policies, septic tanks are more likely than connection to sewer systems. The actual discrepancy would depend upon sewer provision policies in the land conversion market. If there were an inadequate supply and restrictions on septic tanks close in, then development could be more dispersed. FHA new homes sewerred would have the same bias though more pressure for sewers as urbanization occurs or increases is likely to dampen the effect.

The property tax proportion of general revenue as a partial indication of local government financial policies is likely to be



overstated because of the SMSA definition. The rural areas rely more heavily on the property tax whereas more urban areas diversify their tax structure with user charges, etc. However, there is still a great deal of variability within and across metropolitan areas and an average number combined with an SMSA geographical base seriously impairs the reliability of the variable. The empirical results substantiate these problems.

The property tax range and sewer capital outlay range also likely include jurisdictions at the periphery of the SMSA which, while relying primarily on the property tax, have relatively low average per capita property taxes. Therefore, the range of both of these variables is probably greater because of the inclusion of both the central cities and rural areas averaged into the county data available for each SMSA. The implications of this are again not clear. Each range is likely greater than it would be if only land conversion market jurisdictions were included. It is unlikely that the variation is consistent across jurisdictions.

The census definition of urbanized area was used for total population, percent change in population, and mean family income. While this definition usually does not include all of the land or population in the fringe, it is probably much closer than the SMSA. It does, however, also include central city data and, therefore, reflects unspecified interaction between the central city and suburban areas.

Development costs and agricultural opportunity costs have been discussed in Chapter IV. Development cost data is very rough and based on regions of the country. There is an obvious need for city specific

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data. The agricultural opportunity cost calculation could be improved by closer examination of land and farm types in metropolitan areas. However, given the difficulty with other variables and the statistically consistent significance of this variable, time would be better spent improving the definition and measurement of other variables.

Preliminary Interpretation of Econometric Results

What could be the recommendations based upon the results of the econometric results? Site price and appreciation, in general, are explained by total population, percent change in population, income, percent all or new homes with public sewers, property tax range and, for site price, agricultural opportunity cost. In other words, the general model that prices are determined by demand and local government policies which affect supply is supported by the econometric results.

Zoning will be discussed in more detail in the next chapter. Witte (1975) made an argument that site size could be considered a proxy for zoning. Results of the New Jersey research (Sternlieb and Sagalyn, 1971) indicated that zoning minimum lot size requirements were statistically significant in explaining housing prices. Therefore, there is some empirical evidence to suggest a relationship between zoning site size requirements and housing costs and hence site prices. However, site size seems to be a proxy at least twice removed from zoning requirements. Interpretation of site size should, therefore, be guarded. Since this research found the results of the site size variable to be statistically insignificant in the cross-sectional analysis and statistically significant in the pooled regression, no firm conclusions can be drawn on the economic significance of this variable as a proxy for zoning.



With respect to sewer provision, it was hypothesized that the greater the percentage of land in the land conversion market where sewer provision is controlled or restricted, the greater will be site price and appreciation. The operational form of this variable was represented by either percent all or new homes with public sewer. These variables were generally statistically significant in explaining site price and appreciation. Statistical significance with site price might reflect the sewer development costs of the site. However, the statistical significance with appreciation might reflect the relationship of interest. Percent all homes with public sewer should reflect the aggregate of past sewer provision policies in any given metropolitan area. Percent new homes sewerred should reflect current provision policies. If the variables do reflect past or current provision policies, the ambiguities mentioned in Chapter II still need consideration. Either over or under-supply of sewers could produce similar land use patterns, affecting the definition of the land conversion market, but vary prices and appreciation. However, the policies of interest may not be reflected in these variables. For example, if regulations require sewerred lots are assumed more or less the same across metropolitan areas, then the actual amount of sewer system provided will determine the degree of supply restrictions, depending upon demand. Under such conditions the greater amount of sewer system provided will result in lower prices and appreciation. Percent all or new homes with public sewer could reflect past supply policies but possibly not reflect current supply policies. Both sewer and other systems could be restrictive thus constraining development. Essentially, therefore, percent all homes with public sewer might be less



useful than percent new homes with public sewers. The statistical significance of each in explaining site price and appreciation is ameliorated by other policies. Effectively the results of the empirical results suggests, contrary to expectations, that a greater percentage of all or new homes with public sewer leads to greater prices and appreciation. This could mean that current policies are more restrictive as a result of past policies. The policy implications are, therefore, diluted. The results tentatively suggest that if a community wishes sewer homes, providing an adequate supply vis-a-vis demand will keep appreciation down but perhaps keep site prices the same given the sewer proportion of development costs.

The property tax range and sewer capital outlay range had mixed results. The sewer range was almost consistently statistically insignificant. The positive and significant relationship between site price and appreciation and the property tax range suggest that variation in property taxes explains metropolitan variation in those variables. The positive relationship might suggest that community characteristics and services supported by property taxes override the value decreasing effects of the tax. Holding costs could be lower in some parts of the land conversion market, therefore leading to withholding land from a greater proportion of the market. Given the significance of agricultural opportunity cost in explaining site prices, state programs which attempt to lower property tax to farms and hence decrease holding costs are likely to partially explain variation across cities by increasing the property tax range. These policies should be evaluated not only on the basis of retaining agricultural land but also the land

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conversion process and the costs born by others in that process. However, the relatively crude definition of this variable and other complicating factors associated with the property tax precludes firm conclusions or recommendations at this point.

The sewer finance equation at the end of the cross-sectional analysis provided poor results as did the use of the property tax proportion of general revenue. Scarcity and vagueness of data in this area preclude better results.

Clarification of intra-market processes which will help in interpretation and further improvements in future econometric analysis is the primary objective of the next chapter. Zoning will be examined in detail and further analysis with respect to site size will be made. A brief section will also look at sewer provision and property tax aspects of the econometric results when applied to particular cities. The next chapter also examines the variation in dependent variables and the operational form of appreciation, including the geographic definition.



CHAPTER VIII

COMPARATIVE CASE STUDIES:

LANSING, KALAMAZOO, AND JACKSON, MICHIGAN

Introduction

The analysis to this point has focused on national data and statistics and a national econometric model. Chapter VII summarized the substance and implications of that national level model. This chapter addresses the issue of what problems arise from the use of the results of national data when applied to specific situations as represented by the cities of Lansing, Kalamazoo, and Jackson, Michigan. A finer grain of analysis is achieved by examining and comparing the secondary data used in the econometric models with secondary data available for at least these three cities, but not available for a large enough sample for statistical or econometric analyses. In addition, region specific reports such as local land use studies combined with interviews with local planners and developers provide even greater depth.

Specifically both the dependent and independent variables used in the national econometric model are examined across the three case study metropolitan areas. In addition, this chapter examines whether there is evidence to support the theoretic model as well as the empirical results of the national econometric model. Analysis of zoning documents and interviews with developers and planners are also used to examine the usefulness and further refinement of the instrumental variables of interest in this research.



There are several methodological advantages to the comparative case study research technique. Since the three cities are in Michigan, some variables that vary significantly between states or regions will be less significant in explaining variations across the three cities. For example, development costs, since they include the price paid for materials as well as variations in local or state government requirements should vary less across three cities in the same general region. Subdivision regulations which often exist at the state level should also vary less across cities in one state (Sagalyn and Sternlieb, 1971).

At a more general level this research has presented not only a set of specific hypotheses of variable relationships, but also an approach, a simplification of how some local government policies affect land values and uses. While the case study comparison can bring evidence to bear on specific hypothesized relationships, it can also provide insights and arguments to support or contradict the analytic approach. Since earlier parts of this research emphasized static comparisons, this chapter will use that as a base to examine details lost by the cross-sectional analysis (Salter, 1942) but then proceed to draw the insights gained from field interviews into describing the processes and patterns which emphasize the similarities and disparities between the three comparative case study cities.

Much qualitative and quantitative information was provided by interviews with developers. Appendix D describes the comparative case study research and questionnaire. Literature on land conversion has examined some of the issues of developer opinions and behavior. That literature will be briefly noted.



Developer Behavior Literature

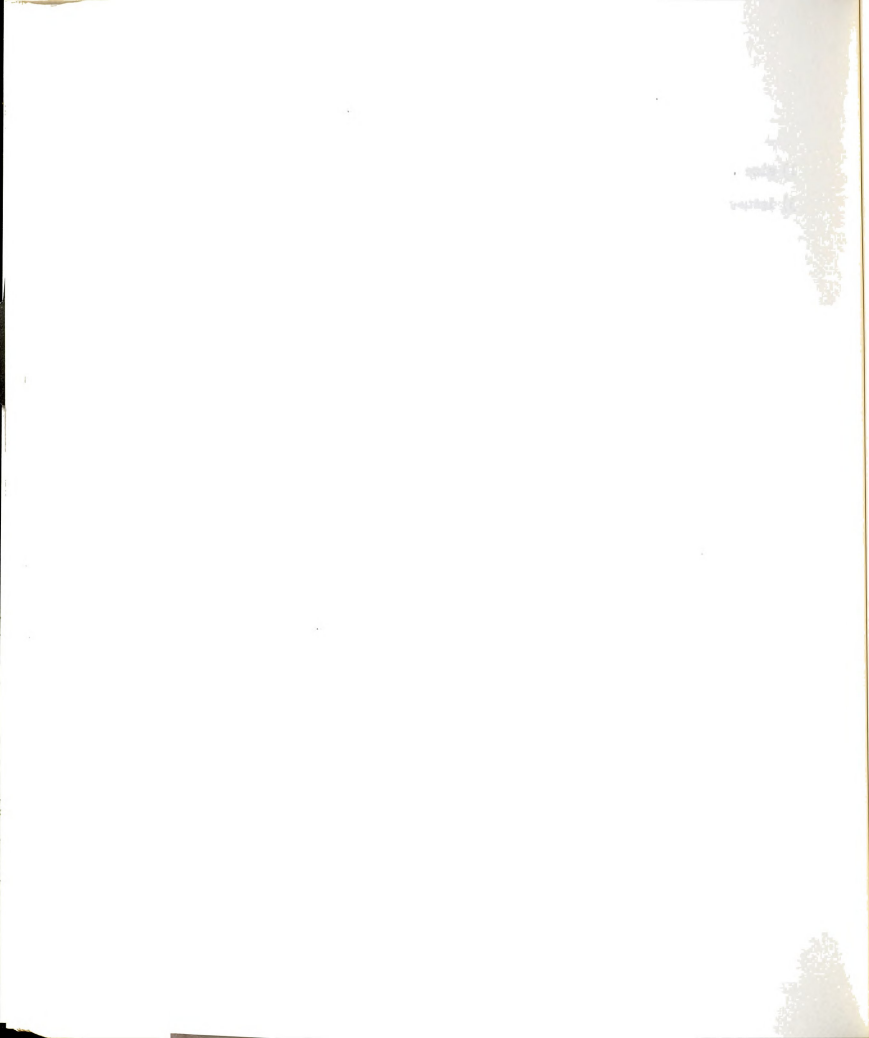
The following aspects of developer behavior will be examined:

- 1) size of firms and market structure, 2) site selection issues, and
- 3) issues revealed in other research on developers.

Developers can be involved in a large number of activities: as land assembler, broker, site planner, builder, subcontractor, sales agent as well as taking "a piece of raw land, lay it out into building lots and streets, install needed services such as sewers and water lines, erect houses or apartments and sell or rent them." (Clawson, 1971, p.58). About thirty-two percent of the members of the National Association of Home Builders who responded to a survey in 1969 were involved in land development. Developers of single family homes were primarily sole proprietorship (Sumicrast and Frankel, 1970, p.90).

Site selection criteria include the size of the parcel, cost of development, accessibility to transportation and utilities, zoning, neighborhood characteristics including community facilities, and local property and other taxes if they vary significantly in the region.

Research indicates that developer concerns include "proper" zoning, access to sewers, the price of land, and the availability of land (Goldberg, 1974). These are associated with the supply of land. Also important is the timing of land purchases with respect to the construction of housing and holding costs. "Increasingly stringent environmental procedures were stretching out the approval process, driving out many developers and reducing profit margins for those who remain." (McMahan, 1976, p.72).



Several issues which are of concern in the analysis of the role of the developer will be substantially untouched. These include the financing factors in a particular market and the leverage problems which might be entailed, as well as the variation in industrial organization of the market from one metropolitan area to another.

Land Values and Land Uses

Preliminary Analyses and Case Selection

This section will compare site price and appreciation across the three case studies. This will include not only the two dependent variables used in the econometric analysis but each of the components used to calculate appreciation: development costs, site size, and agricultural values or opportunity cost. This section, therefore, will closely follow the data and perspective of Chapter IV on Site Price and Appreciation.

Lansing, Kalamazoo, and Jackson, Michigan were selected because they appeared, on the basis of examining the secondary data, to offer some contrast among the cities of Michigan. Table 26 of data for Michigan cities gives some idea of the variations in Michigan cities for variables shown to be significant in earlier research. The particular cities shown had data available for both the dependent and independent variables. Others were excluded because of the lack of data. Detroit was excluded because its size appeared to foreclose detailed examination of the features of interest, such as zoning policies. Proximity to the research base, Michigan State University, and the total population size were by factors in determining the

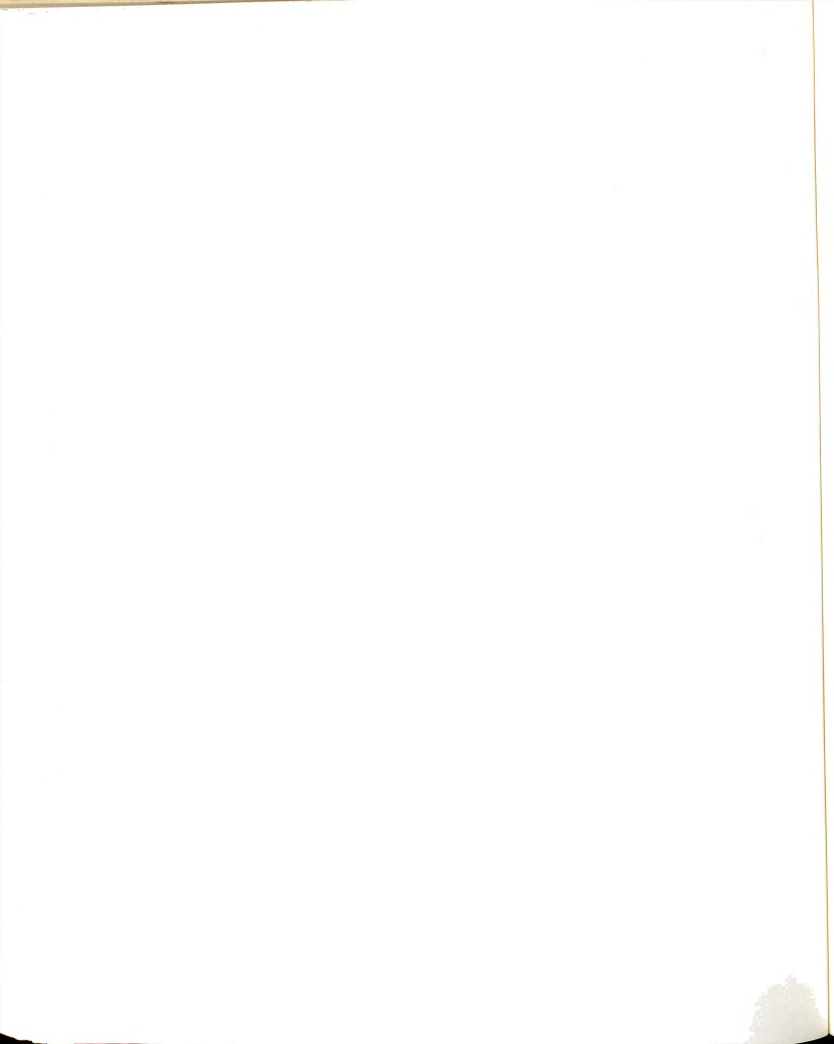
TABLE 26

SELECTED STATISTICS ON SELECTED MICHIGAN CITIES,¹ 1970

Change in Popula- tion (Urbanized Area) 1960-1970		Land Area (Urbanized Area) 1970		Total Population (Urbanized Area) 1970		Population Density (Urbanized Area) 1970		Mean Family Income (Urbanized Area) 1970	
City	Percent	City	Sq. Miles	City	Percent Persons	City	Per Sq. Mile	City	\$
Ann Arbor	5128.	Ann Arbor	54.9	Grand Rapids	352703	Ann Arbor	39269	Ann Arbor	12,722.
Saginaw	1742.	Lansing	35.5	Flint	330128	Flint	3438	Lansing	11,373.
Jackson	1705.	Kalamazoo	29.7	Lansing	229518	Saginaw	3353	Kalamazoo	10,940.
Lansing	1642.	Grand Rapids	19.9	Lansing	178605	Lansing	3104	Flint	19,937.
Flint	1098.	Flint	18.8	Muskegon	52	Kalamazoo	152033	Grand Rapids	10,878.
Grand Rapids	959.	Saginaw	14.2	Ann Arbor	45	Saginaw	147552	Jackson	10,728.
Kalamazoo	670.	Muskegon	10.9	Saginaw	44	Muskegon	105716	Kalamazoo	10,668.
Muskegon	255.	Jackson	10.0	Jackson	36	Jackson	78572	Muskegon	9,379.

Sources: U.S. Bureau of the Census, County and City Data Book 1972, Table 4

¹ Cities ranked from high to low for each statistic.



feasibility of accomplishing the field work. While small sample size precludes statistical analysis, the cases should provide insights on the applicability of the econometric analysis and the land conversion model presented earlier.

Table 27 directly compares Lansing, Kalamazoo, and Jackson with site price and appreciation as well as other data extracted from Table 26. The salient information from Table 27 is the difference in appreciation and site price even though several variables, such as change in population and mean family income, were similar. Total population as well as population density could account for some of the difference. Density, of course, is integral to the policy variables of interest so that policy variation could well be reflected in density. This will be explored further when discussing the instrumental variables. Jackson, on the other hand, provides a different point of contrast. Jackson had a relatively high appreciation but a slow rate of population growth and a much lower mean family income than Lansing, while having a population density similar to Kalamazoo. The contrasts arise from a comparison of Lansing, which seems to follow a land value and use pattern appropriate to its size, with Kalamazoo and Jackson whose preliminary information give some indication of variations from the expected pattern. Kalamazoo's appreciation should be greater and Jackson's less if expected patterns were followed. Local government policies could explain some of this variation.



TABLE 27

SELECTED STATISTICS FOR LANSING, KALAMAZOO, AND JACKSON, MICHIGAN

Urbanized Area (1970)	Site Price NAHB 1969 (\$)	Appreciation NAHB 1969 percent	Total population (persons)	Land Area 1970 Sq. Miles	Population Density 1970 (persons/sq. miles)	Change in population 1970 (percent)	Mean Family Income 1970 (\$)
Lansing	5,333.	1,642.	229,518.	73.	3,438.	35.5	11,373.
Kalamazoo	4,147.	670.	152,033.	73.	2,110.	29.7	10,940.
Jackson	5,409.	1,705.	78,572.	36.	3,182.	10.0	10,668.

Sources: Sumicrast and Frankel (1970) NAHB data. U.S. Bureau of the Census. County and City Data Book, 1972, Table 4.



Table 27 listed site price and appreciation for NAHB data for 1969. Both site price and raw land price for NAHB data and FHA site price data for earlier years are reported in Table 28. The site price and raw land data for Lansing and Kalamazoo conform to the spread in the 1969 data. Jackson on the other hand has more variation. There are several possible conclusions. For one, Jackson site prices might be lower than the 1969 NAHB sample indicated. For another, Jackson could have adopted policies which resulted in greater site price and appreciation by 1969 in the segment of the housing market captured in NAHB data. Comments by developers in 1977 for the three cities indicated that the raw land price ranking among the cities had changed somewhat. In Lansing land cost in the range of \$1500 to \$5000 per acre while in Kalamazoo the range was from \$1000 to \$2000 per acre and in Jackson the range was from \$900 to \$1500 per acre. Without access to a larger sample, which could account for locational factors implicit in the prices given by these developers, one can only note that there could be sampling errors in the NAHB data which over estimates Jackson's site prices and appreciation. For the mean time, however, other factors which could be responsible for higher land values in Jackson will be explored.

Development Costs, Site Size, and Agricultural Opportunity Cost

The components of site price are development costs, site size, and agricultural values or opportunity cost. Developers locally, as nationally, indicate that the cost of lot or site improvements has increased rapidly and faster than land costs since 1970. Estimates by

TABLE 28

SITE PRICE AND RAW LAND DATA FOR LANSING, KALAMAZOO, AND JACKSON, MICHIGAN
FOR AVAILABLE YEARS BETWEEN 1960 and 1969

Year	Lansing			Kalamazoo			Jackson		
	FHA	NAHB	Raw Land	FHA	NAHB	Raw Land	FHA	NAHB	Raw Land
	Site Price \$	Site Price \$	Price \$ Per Acre	Site Price \$	Site Price \$	Price \$ Per Acre	Site Price \$	Site Price \$	Price \$ Per Acre
1960	2494.	3161.	1400.	1899.	2629.	833.	---	2686.	733.
1961	2904.	---	---	---	---	---	---	---	---
1962	3005.	---	---	---	---	---	---	---	---
1963	3098.	---	---	---	---	---	---	---	---
1964	3053.	4300.	2563.	---	3677.	1200.	---	3525.	1050.
1965	3337.	---	---	---	---	---	---	---	---
1966	3269.	---	---	---	---	---	2364.	---	---
1967	4238.	---	---	3003.	---	---	2363.	---	---
1968	4373.	---	---	---	---	---	2633.	---	---
1969	4449.	5333.	---	---	4147.	---	---	5409.	---

Source: Schmid (1968) and Sumucrast and Frankel (1970) for NAHB Data. FHA Data for Cities and States for FHA Data 1960-1969.



one developer in Kalamazoo of the costs of improvements per lot range around \$6400 per lot. The same developer noted that in 1955 land could be purchased for \$1,000 per acre on which three lots could be built which then sold for \$750 per lot. The improvements consisted of gravel roads, leaching basins, gas and electricity. In 1977, land would cost \$2,000 per acre, and 1.8 lots per acre could be built which would sell for \$9,800 per lot. This lot would include curbing, storm drains, sewer, water, gas, electricity (underground), holding ponds, black top road and cul-de-sacs at the end of dead-end streets. A developer in Jackson commented that the requirements for roads were too strict by noting that the State of Michigan didn't even build their roads as well as developers are required to do. One developer in Lansing prepared a breakdown of development costs replicated in Appendix E. These development cost figures compare favorably with the data presented in Chapter IV and is consistent with both earlier research and comments by other developers about the recent steep increases in development costs. There seems no disparity in development costs between the cities though there is some indication that Jackson is on the low end of the scale. Development costs have increased in all three cities, however, the larger size of Lansing and the earlier pressure of high density growth and the sewer and water requirements with that growth entailed more serviced lots. The financing and installation of those facilities would have an effect on the variations between the three cities.

The effect of the increase in land and development costs on the number of lots per acre is not clear from the comments of the developers interviewed. While one developer noted a decrease in his lot per acre



ratio, the other developers indicated 2.5 to 3 lots per acre which is not a notable change from results reported in earlier research.

Variation in the average number of lots per acre could be a function of the type of home being constructed. Other developers indicated a lot to acre ratio of 1.5 to 3 and as high as 5 per acre where allowed; planned unit developments, for example.

Developers observed the trend that all available small lots were used because of the lot to house ratio of housing prices. Smaller houses increased the size of the market for houses. But site size is a somewhat different issue from how many lots per acre in that road improvements could be taking up more space while the site size remained the same, hence less lots per acre. Preferences regarding site size can be reflected in zoning ordinances and administration. While most of the developers interviewed were building for higher income brackets, a few of those interviewed would have liked to have built on smaller lots and sold lower priced homes, therefore reaching a larger share of the potential market. This behavior indicates that the pressure for building on smaller sites exists. Trends exhibited in national data for smaller lots conform to these findings. If smaller sites for whatever reason are in short supply the price of those sites will be bid up.

Another aspect of the site price is the value or opportunity cost of agricultural land. One developer in Kalamazoo, commenting on perceived differences in land values between the three cities, speculated that agricultural land was more valuable in the Lansing and Jackson areas. Table 29 presents agricultural land value data. The



TABLE 29

AGRICULTURAL DATA FOR COUNTIES IN THE LANSING, KALAMAZOO
AND JACKSON, MICHIGAN AREAS 1969, 1974

	LANSING						KALAMAZOO		JACKSON	
	Ingham County		Eaton County		Clinton County		Kalamazoo County		Jackson County	
	1974	1969	1974	1969	1974	1969	1974	1969	1974	1969
All Farms - Number	1332.	1399.	1686.	1782.	1730.	1981.	1122.	1194.	1391.	1577.
Land in Farms - Acres	228527.	230949.	243121.	259883.	261743.	286958.	177214.	185274.	250652.	258094.
Average Sized Farm - Acres	172.	165.	144.	146.	151.	145.	158.	155.	180.	164.
Farms with Sales over 2500 - Number	501.	679.	644.	894.	411.	853.	448.	573.	583.	841.
Value of Land & Buildings - (1000\$)	155324.	92128.	131475.	80933.	143744.	94449.	121946.	76257.	130502.	75817.
Average per Farm (\$)	116609.	65853.	77981.	45417.	83089.	47677.	108686.	63867.	93819.	48077.
Average per Acre (\$)	680.	399.	541.	311.	549.	329.	688.	412.	521.	294.
Value of Agricultural Products Sold per Farm (\$)	23914.	12295.	14459.	7892.	20087.	10380.	23550.	11495.	17152.	10131.

Source: U.S. Bureau of the Census, Census of Agriculture, 1974. Michigan State and County Data.



three county average value of land and buildings per acre for the Lansing area was \$590, while Kalamazoo County was \$688 and Jackson County was \$521. It could be argued that the farm land in Kalamazoo is under greater urbanized pressure than the Jackson area or the three county Lansing area. Moreover, the value of agricultural products per farm indicates the same relationship. However, county data can hide great variation in land types. While agricultural land is often the best land for urban developments, it may not be the land being developed. Several individuals in Kalamazoo indicated that the best agricultural land is not being developed because of an ample supply of non-agricultural land or poor agricultural land. This may account for some equalization of agricultural opportunity costs between cities. The agricultural land use in each county in Table 30 does indicate less land available in Kalamazoo for urban use but a larger urban use given the density which is basically the census urbanized area thus including much vacant developable land in the city of Portage.

Recall here also the technique used to calculate the agricultural opportunity cost in the econometric analysis. While earlier work used statewide average farm values, the calculation of the Michigan statewide average attempted to compare land prices in urban counties to rural counties with the same general kind of agriculture. For 1974, the Michigan calculation of 17 counties was \$518 which was very close to Jackson County's \$521 but substantially less than the \$688 and \$680 in Kalamazoo and Ingham counties. Ideally the calculation of the agricultural opportunity cost would be for the types of farms in each land conversion market or even submarket. However, some of the increased farm value is due to market proximity or savings in

1000
1000
1000

TABLE 30

LAND USE IN COUNTIES IN THE LANSING,
KALAMAZOO, AND JACKSON, MICHIGAN AREAS

	INGHAM COUNTY			LANSING			Eaton County			JACKSON			KALAMAZOO		
	Acres	Percent		Clinton County	Acres	Percent	Acres	Percent		Acres	Percent		Acres	Percent	
Total Area	358,400.	100.		366,720.	100.		366,080.	100.		458,880.	100.		371,200.	100.	
Inland Water	704.	0.2		704.	0.2		576.	0.2		12,032.	2.6		11,712.	3.2	
Land Surface	357,696.	99.8		366,016.	99.8		365,504.	99.8		446,848.	97.4		359,488.	96.8	
Forested	58,300.	16.3		45,000.	12.3		55,800.	15.3		95,700.	21.4		78,500.	21.8	
Agriculture	230,449.	64.5		386,958.	78.4		259,883.	71.1		258,049.	57.8		185,274.	51.5	
Transportation	16,800.	4.7		12,392.	3.4		13,923.	3.8		18,694.	4.2		17,460.	4.9	
Recreation	6,702.	1.9		8,807.	2.4		233.	0.1		15,280.	3.4		9,517.	7.7	
Urbanization	34,981.	9.8		4,190.	1.1		8,117.	2.2		9,151.	2.0		57,668.	16.0	
Other	9,961.	2.8		8,669.	2.4		27,548.	7.5		49,974.	11.2		11,069.	3.1	

Source: County and Regional Facts ... For the Michigan Counties of: Ingham, Clinton, Eaton, Jackson, Kalamazoo.



transportation costs. The conclusion is that the calculated agricultural opportunity cost used in Chapter VII and summarized in Appendix C stood up reasonably well when compared to other local data in Michigan.

Towards Defining the Land Conversion Market

The approximation of the land conversion market used in earlier research consisted primarily of the use of census definitions of Standard Metropolitan Statistical Areas (SMSA's) or urbanized areas. The comparative case studies provide some insight on the validity of these definitions when working with concepts such as the rural-urban fringe and the land conversion market. The greater detail of the case studies also highlights the complexity of the market and the simultaneous determination of many of the variables considered here.

Table 31 shows the population for the jurisdictions of interest and the areas of population growth in the three metropolitan regions. Also listed in Table 32 is the population data for the SMSA and urbanized areas.

The data indicate which jurisdiction have gained population in each of the three metropolitan areas for the 1960-1970 time period. Particularly active areas relative to each land conversion market are Delta and Meridian Townships in the Lansing area; Summit, Leoni, and Spring Arbor Townships in Jackson; and Comstock Township and the City of Portage in Kalamazoo. Care should be taken, however, not to over-emphasize the policies of these communities since, as hypothesized, the policies of jurisdictions which are not growing could also be directing the location of new homes away from their jurisdictions. For example,

1870

1871

1872

1873

TABLE 31

TOTAL POPULATION AND PERCENT POPULATION CHANGE FOR LANSING,
KALAMAZOO, AND JACKSON, MICHIGAN JURISDICTIONS, 1960, 1970

Metropolitan Area and Jurisdictions	Total Population 1970	Total Population 1960	Percent Change in Population 1960-1970
LANSING			
Ingham Co.	130,345.	107,807.	20.9
City of Lansing Eaton Co.	1,192.	---	---
City of East Lansing	47,540.	30,198.	57.4
Lansing Township	11,127.	14,387.	-22.7
Meridian Township	23,817.	---	---
Delta Township	17,396.	7,627.	128.1
DeWitt Township	9,909.	7,649.	29.5
DeWitt City	1,829.	1,238.	47.7
Delhi Township	13,795.	16,590.	-16.8
Holt City (unincorporated)	6,980.	4,618.	44.9
JACKSON			
City of Jackson	45,484.	50,720.	-10.3
Blackman Township	16,997.	16,050.	5.8
Summit Township	21,754.	18,101.	20.2
Leoni Township	13,953.	11,430.	22.1
Napoleon Township	5,500.	4,350.	26.4
Spring Arbor Township	5,650.	3,631.	55.6
Spring Arbor City (unincorp.)	1,832.	---	---
KALAMAZOO			
City of Kalamazoo	85,555.	82,089.	4.2
Kalamazoo Township	22,301.	20,166.	10.6
Parchment	2,027.	1,565.	29.5
Richland Township	3,728.	2,574.	44.8
Richland City	728.	511.	42.5
Cooper Township	7,666.	5,966.	28.5
Comstock Township	10,465.	8,702.	20.3
Comstock City	5,003.	---	---
Galesburg Township	1,355.	1,410.	-3.9
Portage Township	33,590.	---	---
Texas Township	3,187.	2,360.	35.0
Pavilion Township	3,691.	2,575.	43.3

Source: U.S. Bureau of the Census, Census of Population, Michigan,
1972.

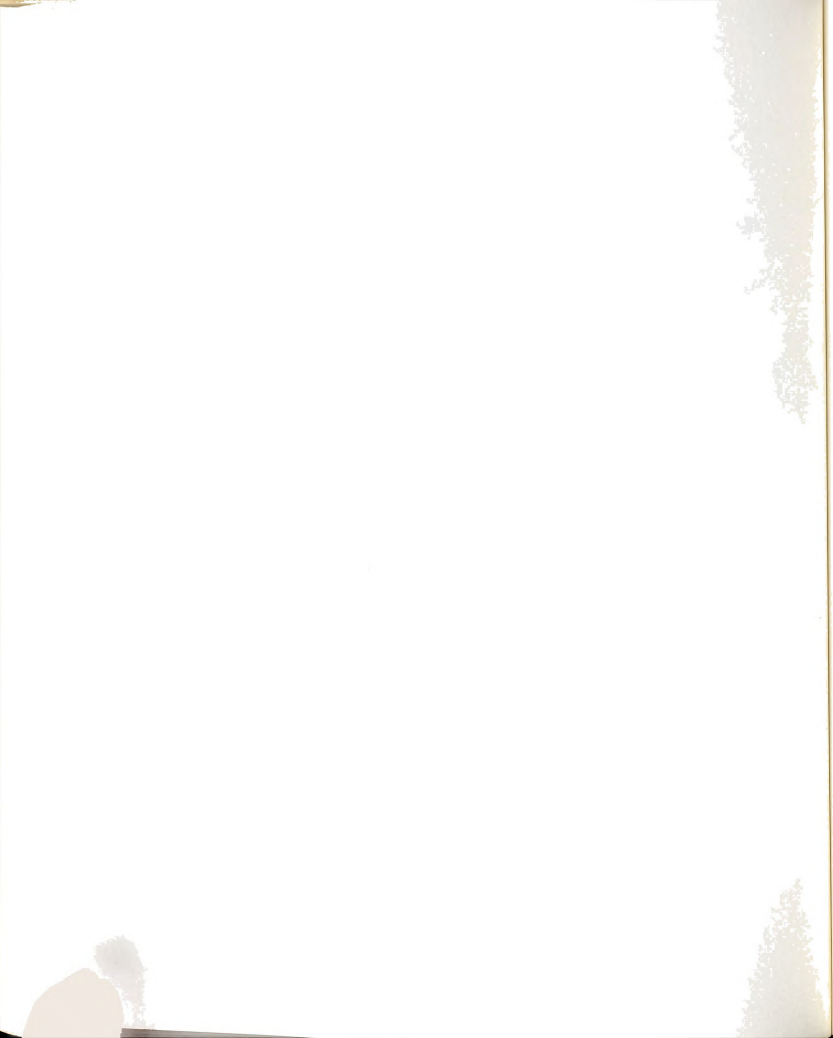


TABLE 32

SELECTED STATISTICS FOR LANSING, KALAMAZOO, AND JACKSON,
MICHIGAN, URBANIZED AREAS 1960 AND 1970

Urbanized Area	1970				1960			
	Total Population (persons)	Percent Distric- tion	Land Area (sq. miles)	Popula- tion per sq. mile	Total Population (persons)	Percent Distric- tion	Land Area (sq. miles)	Popula- tion per sq. mile
Lansing	229518.	100.	73.4	3127.	169325.	100.	472.	3587.
Lansing City	131946.	57.3	33.4	3939.	107807.	63.7	21.2	5085.
Outside Central City	97972.	42.7	40.	2449.	61518.	36.3	26.0	2366.
Kalamazoo	152083.	100.	73.3	2075.	117224.	100.	41.5	2825.
Kalamazoo City	85555.	56.3	24.5	3492.	82089.	70.	23.5	3493.
Outside Central City	66528.	43.7	48.8	1363.	35135.	30.	18.	1952.
Jackson	78572.	100.	36.1	2177.	71412.	100.	22.1	3231.
Jackson City	49484.	57.9	11.	4135.	50720.	71.	10.5	4830.
Outside Central City	33088.	42.1	25.1	1318.	20692.	29.	11.6	1784.
								Percent Change in popu- lation 1960-70
								35.5
								22.
								59.3
								29.7
								4.2
								89.3
								10.
								-10.3
								59.9

Sources: U.S. Bureau of the Census, Census of Population, U.S. Survey, Jan. 1972.



strictly upheld very low density zoning could force population growth pressures for homes into jurisdictions which allow higher density user. The policies of the non-growth jurisdictions could, therefore, be integral to the operation of the land conversion market. So the size and kind of growth in different land conversion markets depends on more than where subdivisions are built. The census definitions of Standard Metropolitan Statistical Area and Urbanized area can both include and exclude relevant jurisdictions and cannot serve reliably as the basis for analysis of the land conversion market. However, granting that lack of reliability, and the fact that finer grain of analysis does not capture all of the jurisdictions of interest, there are no alternatives to these definitions unless each market is analyzed. This is clearly costly. Until that cost is borne, care will have to be applied to results using those geographical definitions.

Instrumental Variables

Zoning

Introduction

An important reason for choosing the comparative case study approach was to examine the possibilities for operationalizing or defining zoning in such a way as would be meaningful for cross-city statistical analysis. Also conclusions from earlier research, which used other means to define zoning or proxies for zoning, could be reexamined as zoning is considered in this section.

There are three primary components to what follows. First, available information from zoning and land use maps and the likely

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data gathering problems will be explored. Second, the response of the planners and developers interviewed regarding zoning and the land market will be summarized. Third, conclusions will be drawn on both the specific zoning hypotheses from Chapter II and the form zoning variables should have in cross-sectional analysis.

Zoning and Other Maps

Initially the zoning in each of the relevant jurisdictions in a land market can be examined by means of the zoning ordinance and map. To analyze the whole land market requires gathering and aggregating the data from the zoning ordinance and map for each jurisdiction. This section will principally discuss what can be learned from zoning maps individually within and aggregated for the land market. Many of those comments are also appropriate to the zoning ordinance which fills the dual role of defining various aspects of zoning and delimiting the process of zoning and zoning changes. These comments are generalizations from the examination of the zoning maps and ordinances of all of the nearly thirty jurisdictions in the Lansing, Kalamazoo, and Jackson metropolitan areas.

The zoning map is static, capturing the situation at one point in time and can often be out of date. The kind and direction of zoning changes is not captured, therefore losing much of the instrumental implications. Some means of cataloging changes over time would not necessarily provide adequate information future decisions. For that matter any interpretation of zoning maps in relation to the supply of land for development would have to be related to current land uses for which it is even more difficult to obtain timely information or maps.

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This information would give an indication of what has been developed and perhaps, when combined with physical and geographic information, what could be developed. The resultant information would be the amount of developable land zoned for different categories. Exclusive or cumulative zoning would have to be differentiated both for individual jurisdictions and certainly in the aggregation process. In effect, cumulative zoning would present serious difficulties in interpretation on the eventual land use implications. However, even well defined exclusive zoning would not contribute much if the extent of demand for development, the ease of zoning changes and the public service and tax situation were unknown.

On the other hand, an examination of the zoning map alone, or preferably with some indication of current land use, can be a take off point for gathering the aforementioned other information, extent of demand, etc., and also provide the basis for defining and examining the role of this instrumental variable in the land conversion process. For example, the zoning and land use maps examined indicated gaps in development, remote subdivisions (likely not to be sewerred), remote multifamily zones (also likely not to be sewerred or perhaps not built at all because of that remoteness) and leapfrog development. Also strip development and spot zoning were apparent and lent support to the idea that zoning often follows development. Other land use patterns demonstrated by a simple examination of zoning maps were the continuous low density residential sprawl and the extent of that type of development. Amenity proximity such as lakes, highways, schools also was apparent.



By providing this information zoning maps can prove useful in deciding the proper grid size for examining current practices and future changes in zoning. Where strip development and spot zoning or leapfrog zoning exist smaller grids are called for while continuous low density development can allow for a larger grid for analysis. An analysis of present zoning could also aid in understanding past development and zoning's role via land use pattern and its effect on past land values trends which serve to a degree as the base for future land values. For example, spot zoning or strip development resulting from same could have lowered aggregate land values. The existence of this kind of land use pattern will affect future development by limiting high anemity locations near such areas.

The need for current land use information combined with current zoning information is needed to have a reasonable idea of potential supply. Vacant lots, which are becoming a major feature of American cities, are often completely missed and hence are unlikely to be considered in any policy analysis, except in hypothetical terms.

Aggregation of zoning map information compounds difficulties arising from analysis of individual maps. The detail listed above is lost and the need to resolve different zoning ordinance definitions into a common system is cumbersome and arbitrary. Zoning categories won't overlap and division of one definition into another is a blind decision. Again if there is no current land use information for the entire metropolitan area the numbers aggregated by jurisdiction and land market from the zoning map are meaningless.

If, however, there is adequate land use information, the resultant zoning information can reflect the nominal zoning in an area



allowing some comparisons across jurisdictions and across land markets and perhaps be indicative of the variance across jurisdictions and markets. Again nominal zoning probably does not reflect actual supply or, from the developers point of view, opportunities to build. Also old patterns do not necessarily represent present policy. While remote unsewered subdivisions were at one time allowed in one township they are now discouraged by a combination of zoning and septic tank restrictions. But the ratio of zoning for undeveloped land to present zoning or use categories can give some indication of policies such as the over zoning for industrial uses or under zoning for certain residential uses particularly if combined with other demand and supply information. Some of what this information entails is discussed in the next section.

Developer and Planner Comments on Zoning

One of the principal concerns raised in the previous section was the degree to which nominal zoning represented actual opportunities to build. In examining this issue, comments from developer and planner interviews ranged over the following: 1) uncertainty in Michigan court zoning decisions and implications on developer and local government interaction, 2) developer location decisions, 3) procuring zoning changes, 4) impact of neighborhood groups interested in zoning and development administration, and 5) the loss of agricultural land. These comments were related to general issues involved in zoning or issues raised in reference to a particular jurisdiction which was of a generalizable nature and jurisdiction specific comments.

According to Williams (1974) zoning in Michigan has been the most erratic of all states. Bronstein and Erickson (1973) also

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analyzed zoning in Michigan and noted that the seemingly uncertain nature of court decisions influenced the interactions between jurisdictions and developers. They believed, for example, that court costs prevented smaller populated, rural township jurisdictions from going to court which resulted in the granting of all or most requests for zoning changes to avoid court actions and the associated legal costs. Part of this behavior could simply reflect different preferences in some smaller jurisdictions. One township in the Lansing area which has been growing and hence can be considered neither poor nor rural has had frequent court cases involving zoning. According to a township planner a recent case, which was lost in Appeals Court, was not contested to the State Supreme Court because of the cost and the uncertainty of the court decision. The case involved the location of a multiple family unit near a single family residential area.

Multiple family unit zoning was an issue raised frequently by the developers and planners interviewed. There are many requests for zoning changes to multiple family uses. If sold or used for that purpose, the gain to the owner is greater than for other residential purposes. However, this is often met with the opposition of local groups concerned, among other things, with the effect of multiple family housing on taxes and property values. In response to this, some developers have attempted to locate multiple family housing some distance from single family neighborhoods, within the range of available regulations and access to services and transportation. One reason for this is the extensive delays and costs in getting a change in zoning if controversy exists. Also of note is the tendency of some

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jurisdictions to zone land for multiple family housing quite far from developing areas and services to discourage such development. This, of course, increases requests for zoning changes nearer to developing areas. Either zoning multiple family use away from developing areas and/or not granting multiple family use zoning near existing development could, therefore, lead to leapfrog development. One planner in Kalamazoo commented that once such multiple family housing leapfrogging occurs the kind of development which fills in between the urban area and such uses are often undesirable uses in relation to the land use plan.

Of basic interest to the comparative case studies was the question of whether there was some aggregate difference in the zoning affecting the land conversion markets of Lansing, Kalamazoo, and Jackson. The general impression from the planner and developer interviews is that there is less land available for higher density uses in the Lansing area than in Kalamazoo and Jackson. While the central cities of each metropolitan area encourages multiple family dwellings when feasible, more area is open to a variety of residential uses in the Kalamazoo area. One developer in the Lansing area stated that he would not buy land for multiple family uses unless it already had the proper zoning. This same developer also gave a detailed account of problems associated with starting a Planned Unit Development which eventually had to be dropped because of local citizen opposition. On the other hand, the city of Portage which is within the urbanized area of the Kalamazoo metropolitan area has a rather large Planned Unit Development well underway and is generally considered to be open to a variety of developments. In the Lansing area, even where multiple

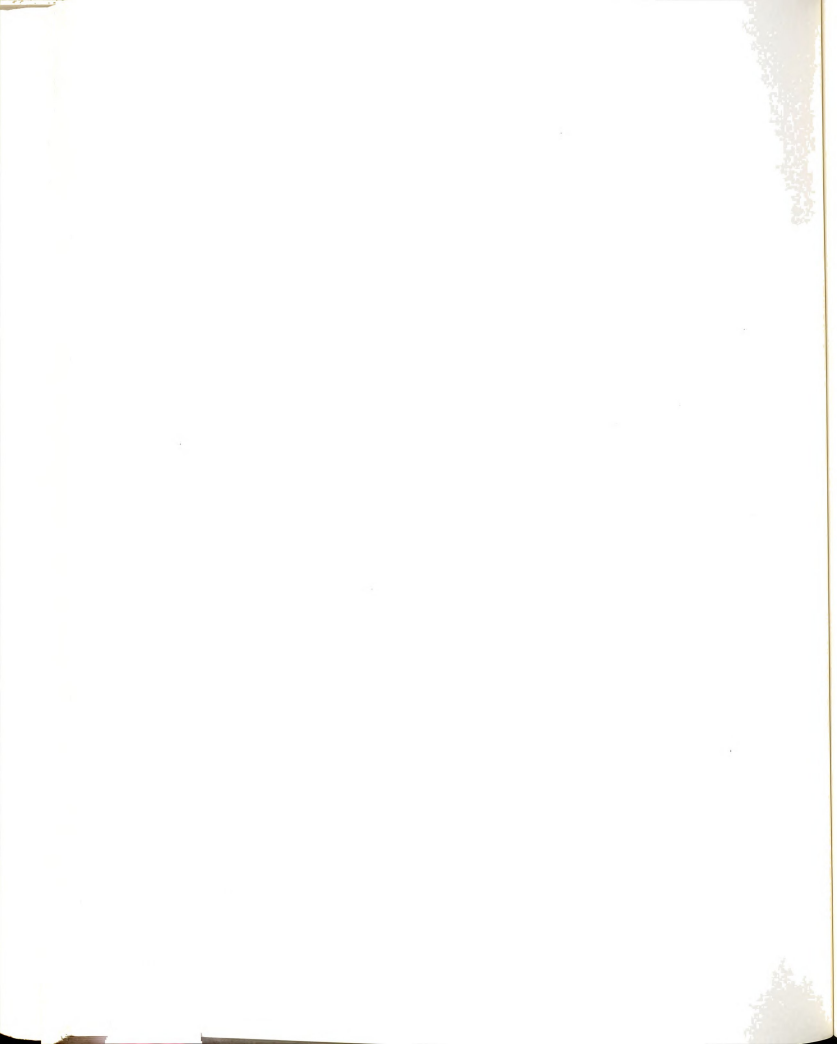
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family units are more easily zoned, the other public service policies limit the land available to specific geographic areas. While low density or exclusionary zoned townships are found in all three metropolitan areas, the relative degree and importance of the jurisdictions in the Lansing area is greater.

Nevertheless, in all three metropolitan areas some jurisdictions follow policies encouraging various forms of sprawl. Jackson has a clear case of ribbon development along a highway into the city. One Jackson planner commented that developers in effect make the decisions in that jurisdiction. The result has been scattered subdivisions and no control of commercial locations along the ribbon. Zoning changes are granted liberally in several of the growing jurisdictions around Jackson and Kalamazoo. In some cases this leads to leapfrog land use patterns.

To summarize, in the Jackson metropolitan area higher density residential zoned land is easier to obtain because most zoning favors growth and multiple family units are permitted without much difficulty in all of the jurisdictions. The Kalamazoo area is amenable to a range of density patterns though some areas favor low density residential uses. Developer response to those jurisdictions is to build in jurisdictions where there is less opposition to/or denser development is allowed. Finally, Lansing seems to provide the smallest supply of land for higher density uses while encouraging low density residential land use.

The implications for aggregate analysis are clear. No single measure of zoning, either site size or nominal zoning, will properly reflect the supply implications of zoning. Both site size and zoning



could be rough proxies for zoning but it is the actual functioning of the processes which seem more critical to future planning. However, the relationship between site size of new homes and nominal zoning might prove informative in judging how successful site size can function as a proxy for zoning, given that site size is a more readily available variable.

Sewer Provision

The cross-sectional econometric analysis demonstrated a consistent and positive association between the percent of new or all homes sewerred and the dependent variables. In Chapter VII it was noted that either of these variables might reflect greater restrictions but that there was no direct indication of the amount of sewer system provided, therefore these variables were ambiguous without that information. In 1970 the data for all homes with public sewer (SMSA) was 72% for Lansing, 45% for Kalamazoo, and 37% for Jackson. Given the size difference between these cities, the relationship between total population or some other size variable with the amount of homes sewerred should be explored further.

If the developer pays for installing the sewer, the cost is passed on to the site purchaser. It is possible, then, that part of the difference in site prices is accounted for by different levels of sewer service. According to comments by developers in each region, county health departments had become increasingly more stringent. Awareness and degree of restrictions seem proportionate to the degree of urbanization across the three metropolitan areas. One of the responses to the costs of sewer provision and restrictions on septic



tank use was noted by a developer in Kalamazoo. To avoid the costs and regulations less expensive lots were being developed in the next county where septic tanks were permitted. This location was significantly distant from the work locations in Kalamazoo and even outside the SMSA, thus compounding difficulties in analyzing the land conversion market when current geographical units are inadequate to capture all of the relevant phenomena.

Sewer connection fees or rates were generally not considered important by the developers and planners interviewed. One notable exception was DeWitt township in the Lansing area, which recently extended its interceptor sewer with high tap in or connection fees to pay for it. However, the plant capacity is at least temporarily unable to absorb the increase so that, given restrictions on septic tanks, population growth is inhibited north of Lansing except by leapfrogging to DeWitt City which has its own sewer system.

One other contrast arising out of the interviews was the difference in amount of sewer services provided by different jurisdictions. In the Lansing area Meridian township allows a developer to extend a sewer to any location. The township is committed to residential development. Thus much vacant land is bypassed. The township portion of the expansion comes out of a general levy. Delta township, also in the Lansing area and also growing like Meridian township, allows sewers only in an area designated for expansion and a more compact pattern is developing, at least while sewer connections are available.

These few insights into local sewer provision and pricing indicate the interaction between sewer provision, pricing, septic tank policy, and the degree of control of sewer locations. Tentatively,

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however, the trends of greater restrictions and greater appreciation are consistent. Nevertheless, this relationship might result from the overall urbanization process. If there is a series of common steps between urbanization and sewer provision and pricing and the effect on land values, a closer examination would seem to have some value.

Interpretation of the sewer results of the econometric research should be ameliorated by such complexity. Each of the aforementioned facets of sewer policy can affect availability or demand, hence one factor such as the proportion of homes sewered reveals little of the process. It can, however, alert the researcher to the importance of the process.

Property Taxation

Because of the complexity of the effects of property taxation on the land conversion market and responses by developers, little effort was made to pursue property taxation issues in the comparative case study. Developer responses to questions about the property tax were of two kinds.

First, the amount of taxes affected their ability to hold land. They purchased land only when they needed it. Red tap exacerbated this problem. Much land was, therefore, purchased subject to successful zoning changes. Tables 33, 34, and 35 give the tax rates and taxes for jurisdiction in Lansing, Kalamazoo, and Jackson metropolitan areas in 1977. The tables do demonstrate large variations in tax rates and, presumably, average per capita taxes paid, though assessed value would be needed for a complete comparison. Therefore, there might be some validity to the property tax range. Instead of county averages, variable or variables accounting for jurisdictional variation in rates,

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TABLE 33

PROPERTY TAX RATES AND TAXES BY TYPE OF JURISDICTION AND STATE EQUALIZED
VALUE FOR LANSING, MICHIGAN METROPOLITAN AREA JURISDICTIONS, 1977

	County			Township or City			School			Total	
	State Equalized Valuation(\$)	Rate Mills	Taxes (\$)	Rate Mills	Taxes (\$)	Rate Mills	Rate Mills	Taxes (\$)	Rate Mills	Taxes (\$)	
<u>LANSING</u>											
Dewitt	52,847,721.	5.53	292,247.	2.96	156,429.	43.04		2,274,615.	51.53	2,723,293.	
Delta	187,009,200.	5.50	1,028,550.	5.00	935,046.	40.16		7,510,784.	50.66	9,474,381.	
Delhi Township	70,907,817.	8.81	624,697.	5.00	345,551.	44.81		3,177,526.	58.62	4,156,776.	
Lansing	117,552,100.	8.81	1,035,634.	5.19	610,528.	41.40		4,866,285.	55.40	6,512,448.	
Meridian	174,617,200.	8.81	1,538,377.	7.62	1,330,233.	50.32		8,786,695.	66.75	11,655,305.	
E. Lansing	158,601,678.	8.81	1,397,280.	17.55	2,783,459.	48.93		7,759,766.	75.29	11,940,506.	
Dewitt City	13,718,786.	5.53	75,893.	13.77	188,907.	41.58		570,398.	60.88	835,199.	
Lansing City	730,342,700.	8.76	6,396,094.	11.57	8,447,483.	43.69		31,911,730.	64.02	46,755,308.	

Source: 1977 City Tax Levy, 1977 Township Tax Levy, State Tax Commission, State of Michigan, Dept. of Treasury.



TABLE 34

PROPERTY TAX RATES AND TAXES BY TYPE OF JURISDICTION AND STATE
EQUALIZED VALUE FOR THE KALAMAZOO, MICHIGAN METROPOLITAN AREA, 1977

	County			Township or City			School			Total	
	State Equalized Valuation(\$)	Rate Mills	Taxes (\$)	Rate Mills	Taxes (\$)	Rate Mills	Rate Mills	Taxes (\$)	Rate Mills	Taxes (\$)	
<u>KALAMAZOO</u>											
Climax	10,631,299.	5.10	54,219.	1.00	10,631.	40.00		425,280.	46.10	490,131.	
Comstock	115,480,699.	5.10	588,951.	3.30	381,086.	40.20		4,641,849.	48.60	5,611,886.	
Cooper	39,452,590.	5.10	201,208.	1.00	39,455.	36.48		1,439,186.	42.58	1,679,850.	
Kalamazoo	120,240,852.	5.10	613,228.	8.56	1,029,161.	42.47		5,107,145.	56.13	6,749,534.	
Oshkamo	70,245,400.	5.10	358,251.	2.00	140,492.	41.51		2,915,985.	48.61	3,414,729.	
Favillon	23,523,929.	5.10	119,972.	1.00	23,523.	36.55		859,748.	42.65	1,003,244.	
Richland	32,311,162.	5.10	164,786.	1.40	45,235.	38.99		1,259,905.	45.49	1,469,927.	
Texas	32,654,910.	5.10	166,540.	1.10	35,932.	37.72		1,231,869.	43.92	1,434,342.	
Kalamazoo City	418,985,850.	5.10	2,136,827.	18.79	7,872,744.	42.87		17,963,278.	66.76	27,972,849.	
Parchmont City	25,512,594.	5.10	130,114.	10.20	260,228.	39.58		1,009,788.	54.88	1,400,131.	

Source: 1977 City Tax Levy, 1977 Township Tax Levy, State Tax Commission, State of Michigan, Dept. of Treasury.



TABLE 35

PROPERTY TAX RATES AND TAXES BY TYPE OF JURISDICTION AND STATE
EQUALIZED VALUE FOR THE JACKSON, MICHIGAN METROPOLITAN AREA, 1977

	County			Township or City			School			Total	
	State Equalized Valuation (\$)	Rate Mills	Taxes (\$)	Rate Mills	Taxes (\$)	Rate Mills	Taxes (\$)	Rate Mills	Taxes (\$)	Rate Mills	Taxes (\$)
<u>JACKSON</u>											
Blackman	108,239,530.	6.95	752,264.	1.00	108,263.	41.82	4,526,950.	49.77	5,357,478.		
Leoni	75,208,129.	6.95	522,696.	2.50	188,030.	41.23	3,101,011.	50.68	3,811,739.		
Mauleon	36,352,812.	6.95	252,652.	1.00	36,364.	39.64	1,440,858.	47.59	1,729,875.		
Spring Arbor	31,689,447.	6.95	220,241.	1.00	31,691.	40.81	1,293,285.	48.76	1,545,218.		
Summit	119,020,567.	6.95	827,192.	1.07	126,891.	43.92	5,226,989.	51.93	6,181,074.		
Jackson	210,415,299.	6.95	1,462,386.	9.64	2,028,952.	45.21	9,513,806.	61.81	13,005,045.		

Source: 1977 City Tax Levy, 1977 Township Tax Levy, State Tax Commission, State of Michigan, Dept. of Treasury.



assessed value or average per capita would seem more appropriate. Regardless of the potential for measuring holding costs, it is more likely that variation reflects preferences for different levels of public services.

Indeed, the second major point made by developers was that taxes, per se, did not seem to be important in residential decisions. Other neighborhood, amenity or school characteristics were more important. If public services were great in these areas, the property tax would be higher and holding costs also greater. But demand would be greater too. As in the case with sewer provision, no clear conclusions can be drawn because of the necessity to look at issues such as the tax base, assessed value, per capita taxes paid, and tax rate. A complete picture might not be feasible given these data needs but there is little evidence to suggest that the property tax range or property tax proportion of general revenue reveal sufficient information on the effect of the property tax.

Undeveloped land is often underassessed and programs designed to relieve agriculture from property taxes encourage land holdings in some cases, for urban sale. This is also encouraged by the significant appreciation in land values between agricultural and urban uses.

Conclusion

The econometric chapters presented a model explaining site price and appreciation with demand, site characteristic, and instrumental variables. Though not statistically significant in the research, site price was interpreted as a proxy for zoning by Witte (1975). Percent all and new homes with public sewer were generally quite robust while



the property tax range held promise. This chapter has compared factors related to the dependent variables such as site size, development costs, and agricultural opportunity costs for three specific locations in Michigan. Site price and appreciation were compared across the three metropolitan areas in addition to an examination of zoning, sewer, and tax issues.

Closer scrutiny of national land value data via interviews with planners, developers, and assessors indicated that the results of the national model should be analyzed guardedly. Total population, percent population change, and income indicated that Lansing and Kalamazoo should have similar appreciation levels while Jackson should be lower. However, appreciation in Lansing and Jackson were similar and higher than appreciation in Kalamazoo. The reliability of the Jackson data is dubious but developer comments supported the difference between Lansing and Kalamazoo. Agricultural opportunity cost, site size, and development costs do not appear to be significantly different between the three areas. There was some variation in the structure of the home building industry. Jackson had large developers from Detroit because the local financing and home building market was not large enough to support larger developers.

In examining the instrumental variables, it is concluded that the degree of zoning restrictions did vary between the three metropolitan areas. In Lansing two of the growing townships either limited the location of development or zoned primarily for large minimum lot sizes. Kalamazoo, on the other hand, appeared to have a sufficient amount of land available for a variety of uses. Zoning around Jackson

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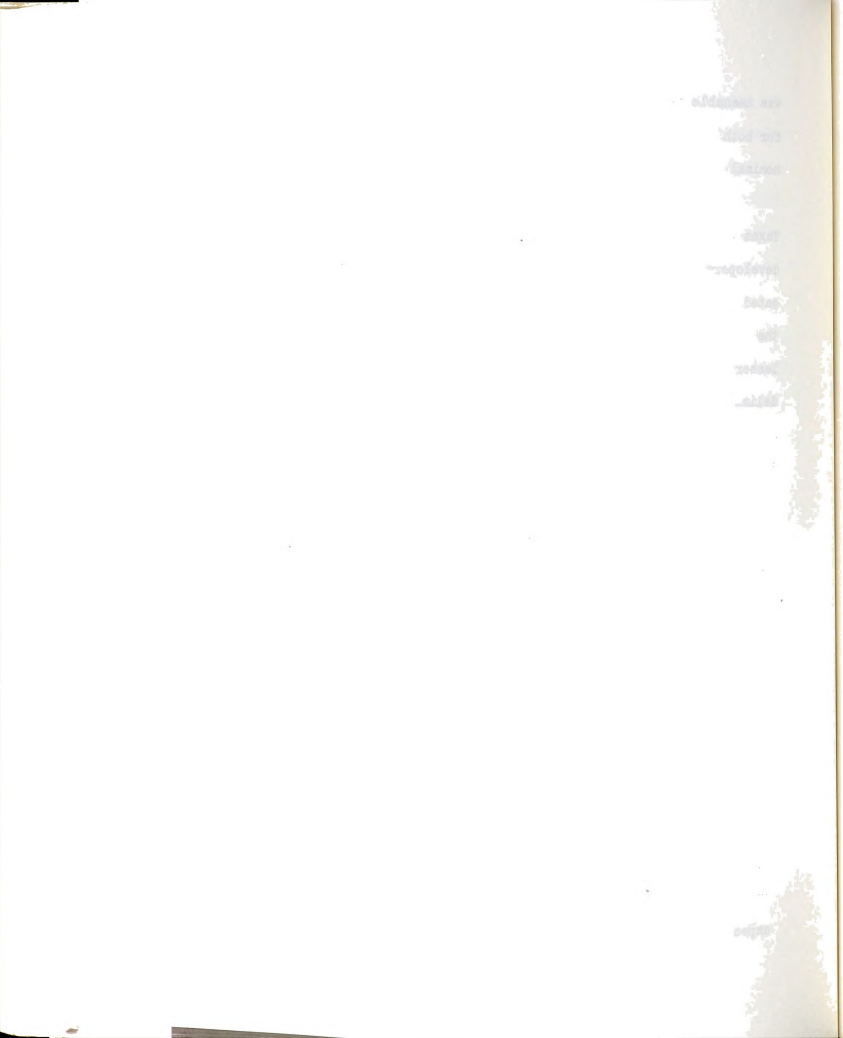
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was amenable to just about any kind of growth. These comparisons account for both the ease of zoning changes as well as static comparisons of nominal zoning.

Sewer provision and property taxation were peripherally examined. Taxes were not considered to be important locational factors by developers, though further reflection and examination might have indicated more of a role with respect to the ability to withhold land from the market in anticipation of future gains. Sewer provision, and to a lesser extent sewer financing, were recognized as important market delimiting factors. For example, where sewer provision was limited and septic tank policies were strict, leapfrogging was occurring. It is interesting to note that neither SMSA or urbanized definitions would have picked up this particular leapfrog pattern. Furthermore, the same metropolitan area, as defined by the census Urbanized Area, included an incorporated jurisdiction which was still growing.

The combination of zoning, sewer, and tax policies and characteristics indicated that there were more problems in getting land for anything other than large minimum lot residences in Lansing than in either Kalamazoo or Jackson. It can tentatively be concluded that these policies account for some of the variation in appreciation between Lansing and Kalamazoo.

With respect to the econometric results, Kalamazoo had a relatively low percentage of homes sewerred but was actively providing those services in areas where demand existed. Therefore, to a certain extent, the percent all homes with public sewer did reflect the expected supply situation in Kalamazoo. On the other hand, sewer



provision was not that difficult in the Lansing area, though controlled more than in Kalamazoo.

The tax rates were lower in Kalamazoo and Jackson than in Lansing. This could also be another growth related factor which helps to shape the urban environment. Descriptive data at least indicate quite a bit of variation within urban areas. Though the variation is generally from central city to the fringe, there is still significant variation around the fringe.

Site size as a proxy for zoning can be brought into question by noting that where zoning or other supply restrictions do not exist. Jackson, for example, consumers can presumably buy bigger lots or, at least, fulfill preferences for bigger lots. Large site sizes could then be the case for both restrictive jurisdictions or areas or unrestrictive areas.

The comparative case study supports the general model of land conversion while raising questions about the interpretation and policy implications of the econometric results. The comparative case study also is suggestive of ways to operationalize the instrumental variables or at least directions future research could take. For example, the extent of unused and planned sewer capacity would be better indicators of provision policies than either past or present homes sewerred.

Finally, developer behavioral comments supported an important theoretical concept developed in this research. That concept stated that supply restrictions arising from local government policies will increase appreciation in that jurisdiction, while the excess demand will shift to other jurisdictions, raising appreciation there too. The degree of this effect will depend upon the variation in policies

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among jurisdictions. Nearly all developers who were interviewed indicated that they were not building in specific jurisdictions because of the attitude of that jurisdiction towards different kinds of development. This process could increase aggregate land value appreciation but could keep the relative position of jurisdictions the same. This increased appreciation creates further pressures on the land use plans of all jurisdictions involved. Costly court suits to get zoning charges and this appreciation are common. It was interesting to note that the concept of a land market was easily understood by developers, perhaps because of the aforementioned process, while planners had difficulty with the concept and seemed inured to thinking in terms of political jurisdictions with little recognition of the interaction of one jurisdiction's policies with other jurisdictions.

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CHAPTER IX

CONCLUSION

Introduction

This chapter has three objectives. The first objective is to briefly summarize the contents and results of this research. Many specific interpretations of both econometric and comparative case study results have already been stated. This summarization will note the major themes and results. The second objective is to determine the policy implications of these results and answer the question of what do individuals or groups support in terms of government policies if they want to keep prices and appreciation down. The final objective is to suggest areas where further research should be directed.

Summary

Chapter II noted that there continues to be a large and growing residual land value which contributes to high residential site prices which is not explained completely by agricultural opportunity costs, site size, improvement costs, or general price inflation. This residual is defined as land value appreciation and is demonstrated in Tables 9, 10, and 11. The underlying economic concept in this research is the distinction between economic rent and profit. Appreciation consists of both. Rent arises from natural limitations in supply which cannot be competed away. Profit, on the other hand, arises from factors which limit supply due to market structure or institutional restrictions. It is these institutions, exemplified by zoning, sewer

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provision and pricing, and property taxation, which are analyzed in this research in terms of their supply restricting effects.

Specifically, hypotheses were developed for zoning, sewer provision and pricing, and property taxation with respect to appreciation. Zoning policies which restrict the availability of land for certain types of residential development, such as high density, single family housing, raise prices and appreciation. The degree to which this effect occurs depends upon the aggregate and jurisdictional variation of zoning policies in any given land conversion market. If a large share of the market has such zoning restrictions, the greater the appreciation. Much the same process could also occur with sewer provision and pricing. The hypothesis is that sewer provision policies which restrict supply relative to demand increases appreciation. Pricing policies such as high user charges can affect the location and movement of demand in a land conversion market. It was also noted that sewer over-supply could lead to a dispersed land use pattern with less expensive sites at the end of the sewer lines being developed first. Finally, the property tax was discussed with a major focus on it's effect on holding costs of land. If taxes were low for undeveloped land then it was easier for the landowner to keep land off the market in anticipation of higher appreciation. While zoning, sewer, and property tax policies are not the sole shapers of the urban land market, they present a range and sample of the local government institutions most likely to affect the market. In general, the model presented tries to advance understanding of the land conversion market and explain variations in appreciation and site prices across metropolitan areas.

Chapter III presented previous research which has concentrated on either intra-urban land values or the demand characteristics involved with inter-urban land value comparisons. The economic theory of rent argues that rent is demand determined. The results of previous research on demand variables were used as a basis for specifying those variables in the model. Because of the use and availability of site prices across metropolitan areas, this variable was also analyzed. This was done to examine the stability of some of the demand characteristics and, more importantly, as a contrast with the measure of appreciation developed by Schmid (1968) and applied in this research.

Site prices available from both the National Association of Home Builders and the Federal Housing Administration, which capture, in part, different sectors of the land market, were used as the basis for calculating appreciation. This process examined the component data and variables needed to calculate appreciation; site size, development costs, and agricultural opportunity costs. Site price and appreciation were the dependent variables. Appreciation was designed to measure both economic rent and profit. Because of the data difficulties with the calculation of appreciation, site prices might be considered a crude proxy for rent and profit. Unfortunately, components of site prices, such as development costs, raise other policy issues and compound difficulties in interpretation. Nevertheless, site prices help to maintain a check and comparison with appreciation. Chapter IV developed these dependent variables.

Chapter V operationalized the independent variables. The independent variables used to explain site prices consisted of demand, variables, site characteristic variables and instrumental policy



variables. Since the site characteristic variables were used to calculate appreciation, only demand and instrumental variables were used in the appreciation model. The demand variables included total population, percent change in population, mean family income, and a regional dummy. The site characteristic variables were development costs, site size, and agricultural opportunity costs. The instrumental variables were the property tax proportion of general revenue, property tax range, sewer range, and percent all or new homes sewerred. The property tax range and sewer range were proxy calculations of the variation in policies which used the high, low, and average per capita property tax paid or sewer capital outlay.

The method used to test the theoretical model consisted of a series of cross-sectional regression equations, pooled cross-sectional and time series equations, and a comparative case study of Lansing, Kalamazoo, and Jackson, Michigan. The regression analysis explored demand variables and the hypothesized relationship between sewer provision, pricing, and property taxation and the dependent variables. The comparative case study examined the geographical basis and dependent variable definitions of the regression work with a finer grain of analysis. Zoning was explored in some detail while sewer and tax policies received cursory treatment. Chapters V, VI, VII, and VIII presented these empirical results and analyses.

The results of both the econometric analysis and the comparative case study are now considered with respect to the zoning, sewer provision and pricing, and property tax hypotheses.



The zoning hypothesis stated that the greater the percentage of low density residentially zoned land in the land conversion market, the greater will be the land value appreciation and site prices in that market. Zoning was examined in detail in Chapter VIII, the comparative case study. The results of examining nominal zoning as well as comments from developers and planners suggested that other factors needed consideration in addition to nominal zoning. The effect of zoning on actual opportunities to build did affect the location decisions of developers. Developers also noted the pressure on land use regulations. This supported the concept of the competition, through the political process, for economic rent and profit. Most important, however, was that differences in land values and appreciation between the three cities could be related to a holistic, qualitative, and quantitative measure of zoning variations.

If it were possible to aggregate various characteristics of zoning such as nominal zoning, nominal zoning changes, time and red tape involved in zoning changes, and the uncertainty of the process, then this holistic variable might prove supportive of the hypothesis. But its interpretation would be difficult. Based on interviews with developers and planners substantiating behavior consistent with perceptions and reactions to restrictive zoning, as well as examination of nominal zoning, the weight of the evidence, as presented in the comparative case study (Chapter VIII), suggests that zoning restrictions for certain uses, in the aggregate, do affect developer decisions, inter alia, and land value appreciation. Especially significant were developer and planner descriptions of jurisdictional attitudes on zoning and responses by developers in the entire land



conversion market. Demand shifts as a result of developer decisions from one jurisdiction to another can lead to higher prices throughout the market. If there are product differentiating effects with respect to large lots, the price increases could be even larger. Similar behavior patterns can be seen with sewer provision and pricing. It was hypothesized with sewer provision that the greater the percentage of land in the land conversion market where sewer provision is controlled or restricted, the greater will be site prices and appreciation. There were several caveats on restrictions associated with too much or too little sewer provision. Restricted supply of sewers should increase appreciation while over-supply would increase price, because of the sewer component of development costs, but lower appreciation. The sewer pricing hypothesis stated that the greater the percentage of subsidization of sewer services in a land conversion market, the greater will be site price and appreciation.

The weight of the research evidence suggests that local government policies regarding both sewer provision and pricing affect the supply of land for certain uses in the land conversion market.

In the econometric analysis the public sewer supply hypothesis was operationalized by two variables; percent of all homes with public sewer and percent of new homes with public sewers. Percent of all homes with public sewer could indicate, in the aggregate, past sewer provision policies while percent of new homes with public sewer could indicate present policies. These interpretations have to be guarded because of the importance of other policies such as septic tank use. Aggregate under-supply can disperse development if septic tanks are

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allowed. Appreciation is, therefore, low. If septic tank policy is tight, appreciation will be high. If sewers are over-supplied, then development could also be dispersed.

While the econometric results were mixed, both the percent of all and new homes with public sewer were frequently statistically significant, at greater than the .01 level, at explaining site prices or appreciation, especially with the NAHB data. Table 13, for NAHB site price data, presents two equations with percent all homes with public sewer statistically significant with a positive sign at the .007 and .006 level, respectively. Table 15 also demonstrates positive results for the NAHB site price regressions while FHA site price regressions were weak, as demonstrated in Table 14 and Table 15. The statistical significance level for all homes with public sewer in the cross-sectional appreciation regressions ranged from a low of .020 to a high of .001 across eight equations presented in Table 16 and Table 17.

In the pooled cross-sectional time series regressions the percent new homes sewerred was statistically significant in the Test of the Covariance Model, Table 19, and the Appreciation Covariance Model, Table 25. However, results in the site price pooled regressions in Table 20, were statistically insignificant. The results of pooled regressions were encouraging and seem to indicate stability of the sewer variable over time.

In addition, comments made by planners and developers in the comparative case study did support the behavioral implications, in terms of developer location decisions, of sewer supply policies. Nevertheless, the difficulty in separating supply policies from sewer use policies makes interpretation of support for the hypothesis cautious.

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Sewer pricing policies were tested by the sewer range in both the cross-sectional analysis and the pooled regression analysis. With the exception of Table 16, in which the sewer range was significant at the .08 and .07 level in explaining appreciation (NAHB), the sewer range was consistently insignificant. Furthermore, Table 18, which tested the sewer charge effect on raw land prices, also yielded poor results. On the other hand, the comparative case study indicated a growing awareness of sewer user charges vis-a-vis location decisions by developers and planners. Combined with sewer provision issues, sewer financing can limit residential growth in some areas and encourage residential growth elsewhere.

Property taxation was tested in the econometric analysis most successfully by the property tax range. This was especially the case with NAHB data as was demonstrated in Tables 13 and 15 (site price) and Table 16 and Table 17 (appreciation). Since the pooled regressions used FHA data, generally insignificant in the FHA cross-sectional results, it is not surprising that the property tax range continued to be insignificant. Developer comments in the comparative case study did not indicate much importance for property tax variations. On the other hand, agricultural opportunity costs in part represent property tax effects on landowner ability to hold land. If the range is large, agricultural land might be taxed closer to use rather than urban market value, thus increasing the agricultural opportunity cost and the ability to hold land. Agricultural opportunity cost was, with the exception of Table 21, consistently statistically significant and positive. A comment by one developer substantiated concern over agricultural land taxation and its effects on land availability. Nevertheless, as

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mentioned in Chapter V, this use value taxation, either de jure or de facto, is likely to delay and change the results of land conversion and raise prices and appreciation rather than achieve agricultural land preservation in the long run.

When the results of zoning, sewer provision and pricing, and property taxation are aggregated, the general model of the land conversion process presented in Chapter II seems generally supported. While the interaction between these and other instrumental variables is complex, the conclusion is that they separately and jointly affect the supply of land and can be a source of appreciation and economic profit associated with land values.

Policy and Research Implications

What do individuals or groups support in terms of government policies if they want to keep prices and appreciation down?

Efforts to lower appreciation will require focusing on all of the governmental jurisdictions in the land conversion market. Figure 1, The Conceptual Model, isolated two issues. This research examined the instrumental policies of local governments and their impact on site prices and appreciation. The structure of local government and its impact on those policies and, hence, site prices and appreciation can be discussed only when the role of the instrumental variables is clear. Tentative policy implications of zoning, sewer provision, and taxation are presented here, however, with some reference to government structure issues in order to present a range of institutional alternatives and to avoid leaping to conclusions often found in this research area.

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As has been noted, zoning policies can increase appreciation which in turn can create pressure on land use policies such as zoning. Variations in the degree to which supply restricting zoning policies exist will affect both developer and consumer location decisions and, perhaps, speculative activity. The greater the aggregate restrictions relative to demand, the greater the appreciation. For those who would like to lower land values created by this interdependent zoning process, the increased values are a negative, pecuniary externality. The commonly used Tiebout (1956) model assumes no intercommunity spillovers, since people can move to communities offering characteristics they want, without consequences for others. Zoning is one tool for this product differentiation.

If it can be assumed that information about the appreciation effects of restrictive zoning will not change behavior, given the interests vested in the current structure and competition for economic rent and profit, then some change in governmental structure is suggested. Jurisdiction by jurisdiction changes to make zoning less restrictive over the entire land conversion market are unlikely to occur because of the benefits gained by those jurisdictions not changing. Various other land use policy options, whether superceding or coinciding with zoning, must account for jurisdictional interdependence. Chinitz and Cowing (1977) have analyzed the argument that metropolitan government be created to internalize externalities and recognized the geographical difficulties and value conflicts inherent in such policy prescriptions. Institutional changes designed to lower land values and appreciation will affect other preferences; small, homogeneous, or high income suburbs, for example.

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Other institutional arrangements exist. For example, transferable development rights, which are designed, in general, to eliminate competition and change the distribution of economic rent and profit by having the winners in the land conversion process compensate the losers by a bargained transaction rather than administrated (zoning) decision, could be exchanged by local government jurisdictions or individuals across the land conversion market. Clawson (1960) suggested several large suburban development districts in a metropolitan area which could have broad planning and infrastructure powers. In California, a similar concept, spheres of influence, is used as a basis for a planning device and organization (Local Agency Formation Commissions). This structure has problems with interacting with existant governmental jurisdictions which limit their effect (Eells, 1977). The merits of any institutional change should be evaluated on many criteria, including demand articulation, production economies, as well as prices.

Many of the same issues arise with sewer provision. Tabors, et al, (1976) argued that, "The stronger and more centralized the control of the institutions responsible for sewerage planning, the more effective the overall policy is likely to be." (p.172). Sewer supply relative to demand and timing also need to be considered within the context of the land conversion market but where the authority is placed and who gets included in the decision process will determine the ultimate impact of any change. The impact of a decision by one jurisdiction to limit sewer supply has, perhaps, clearer implications than zoning on other, nearby jurisdictions. With added concern about the appreciation and land value effects, land conversion market

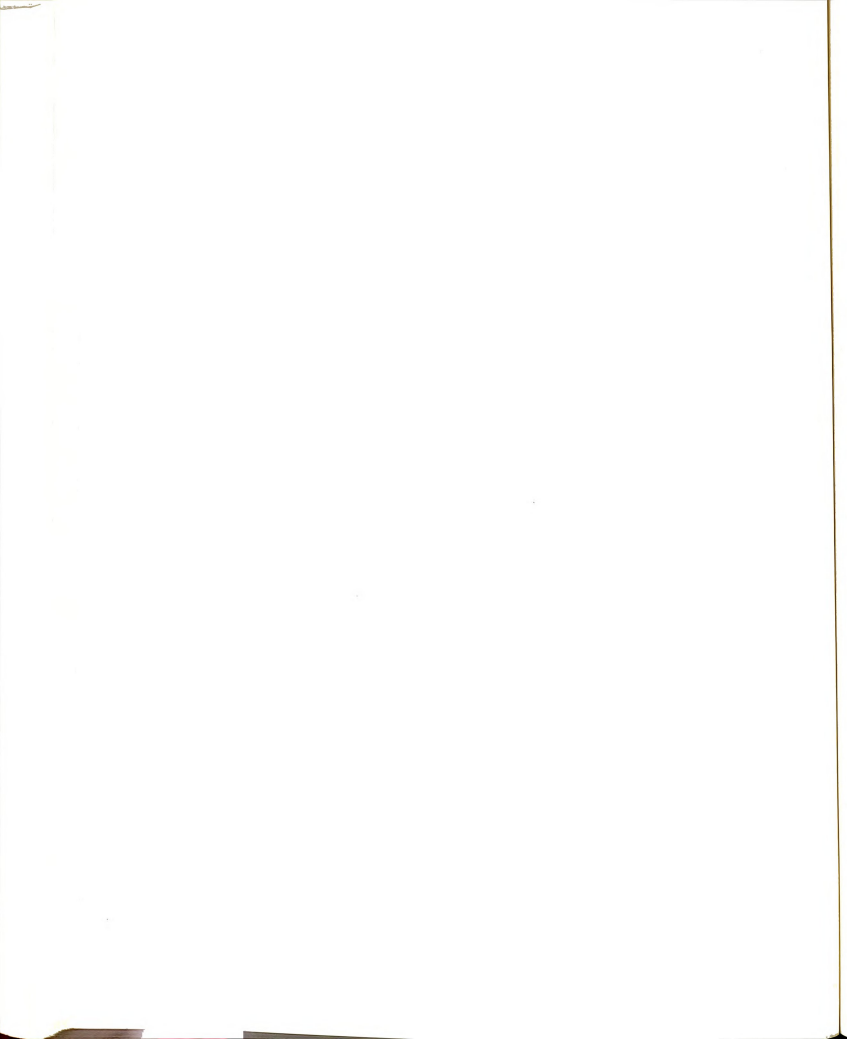
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jurisdictions could bargain within the context of metropolitan planning agencies which are becoming more involved in public service supply issues as federal funding increases.

Agricultural taxation issues might also vary within a land conversion market. The empirical results of this research for the property tax range and agricultural opportunity cost support conclusions by Schmid (1968), Schwartz and Hansen (1973) and McMillan (1973) that lower property taxes lead to capitalization of the lower taxes into the value of the farm. Policies which, therefore, tax agricultural land at use rather than market value are likely to lower uncertainty and allow for an increased short run ability to withhold land from the market and hence, raise appreciation.

Before research into alternative forms of governing different aspects of the land conversion process begins, further research into the instrumental variables analyzed in this research, as well as other policy variables, should occur. Other authors contribute different perspectives to the analysis of policy tools (Greene, Neenan, and Scott, 1974; Mills and Oates, 1975; Portney, 1976; and Downing, 1977). But the complexity of the land conversion process perforce argues for a complex model. It is clear that the aggregate effects of local government policies on land conversion are little understood and have been subject to little empirical investigation.

The research which has occurred, including the results reported here, have pushed the analysis of generally available data to its limits. Better measures of the relationships of interest, obtained through primary data, should replace proxies which do not measure the



relationship of interest and which keep researchers from having further confidence in their results. The contrasts raised between the econometric results and the comparative case study should aid in designing research and survey instruments.

Further analysis and research into land value appreciation and the impact of local government policies, given the increasing size of appreciation, seems advised.



APPENDICES



APPENDIX A

SEWER AND WATER TAP FEES FOR SELECTED JURISDICTIONS
IN METROPOLITAN DETROIT, MICHIGAN, 1969-1974



APPENDIX A

SEWER AND WATER TAP FEES FOR SELECTED JURISDICTIONS

IN METROPOLITAN DETROIT, MICHIGAN, 1969-1974

Robert H. Carey, President of Thompson-Brown Company of Detroit, Michigan reported the data presented in Tables A-1 - A-4 in a series of articles which discussed development costs and local government fees in jurisdictions where Thompson-Brown had developments. Other data on development costs are presented in Appendix B.

Mr. Carey noted that "another cost item that should be considered attributable to land, is that of 'tap' fees, 'use' charges, 'capital improvement' charges, or whatever they are called. The variance from one community to another, or even from one area to another in the same community, is unbelievable." Mr. Carey presented the tables reproduced here without further comment. 1970 and 1971 reports duplicated the data presented in 1969 and are, therefore, not reproduced here. It is possible that the fees did not change for those years, but further analysis is speculative. The data do provide information supporting significant variation in sewer and water financing policies.



TABLE A-1

SEWER AND WATER USE AND TAP FEES, 1969, FOR SELECTED
JURISDICTIONS IN METROPOLITAN DETROIT, MICHIGAN.

	SANITARY SEWER				WATER		COMBINED TOTAL (\$)
	"USE" or Interceptor Charge (\$)	Arm Assessment Charge (\$)	Tap. or Inspection Charge (\$)	Total (\$)	"USE" or Capital Charge (\$)	Tap (1" line) Charge (\$)	
AVON TOWNSHIP	350	None yet	15	365	350	115	830
CLINTON TOWNSHIP	275	None	25	300	100	210.64	610.64
FARMINGTON TOWNSHIP							
13 Mile Arm	350	375	50	775	75	264	1,114
Tarabusi Arm	350	150	50	550	75	264	889
NORTHVILLE CITY							
Ordinary	-No breakdown-			300	150	185	635
Spec. District	300	160		460	150	185	795
NORTHVILLE TOWNSHIP							
	-No breakdown-			400	100	285	785
NOVI VILLAGE							
	-No breakdown-			651	200	252.50	1,103.50
W. BLOOMFIELD TOWNSHIP							
Walnut Lake Arm	250	350	300	900	200	270	1,370
Morris Lake Arm	250	108.14	None	358.14	200	270	828.14
AVERAGE				506			900

Source: Data gathered, compiled and prepared by Robert H. Carey, President, Thompson-Brown Company,
Detroit, Michigan.



TABLE A-2

SEWER AND WATER USE AND TAP FEES, 1972, FOR SELECTED
JURISDICTIONS IN METROPOLITAN DETROIT, MICHIGAN.

	SANITARY SEWER				WATER		COMBINED TOTAL(\$)
	"USE" or Interceptor Charge(\$)	Arm Assessment Charge(\$)	Twp. or Inspection Charge(\$)	Total(\$)	"USE" or Capital Charge(\$)	Tap (1" line) Charge(\$)	
AVON TOWNSHIP	350	None	15	365	350	308	1,023
CLINTON TOWNSHIP	275	None	25	300	100	210.64	610.64
FARMINGTON TOWNSHIP							
13 Mile Arm	350	375	41	766	75	264	1,105
Tarabusi Arm	350	150	41	541	75	264	880
NORTHVILLE CITY							
Ordinary	300	None	None	300	150	175	625
Spec. District	300	160	None	460	150	175	785
NORTHVILLE TOWNSHIP	400	None	6	406	100	315	821
HOWI VILLAGE	729	300	31.50	1,060.50	200	245	1,505
WEST BLOOMFIELD TOWNSHIP							
Walnut Lake Arm	250	345	10	605	200	227	1,032
Morris Lake Arm	250	None	10	260	200	227	687
AVERAGE				506.35			907.41

Source: Data gathered, compiled and prepared by Robert H. Carey, President, Thompson-Brown Company,
Detroit, Michigan.



TABLE A-3

SEWER AND WATER USE AND TAP FEES, 1973, FOR SELECTED JURISDICTIONS IN METROPOLITAN DETROIT, MICHIGAN.

	SEWER				WATER				COMBINED TOTALS(\$)
	Use Charge(\$)	Use Charge(\$)	Inspection Charge(\$)	Total Charges(\$)	Use Charge(\$)	Tap Charge 1" Line (\$)	Const. Use Charge(\$)	Inspection Charge(\$)	
AVON TOWNSHIP	350	None	15	365	350	350	10	15	725
CLINTON TOWNSHIP	275		25	300	100	200	5.64	5	310.64
FARMINGTON TOWNSHIP									
13 Mile Arm	350	375	41	766	75	264	None	6	345
Tarabusi Arm	350	150	41	541	75	264	None	6	345
10 Mile Arm	350	900	41	1,371	75	264	None	6	345
Grand River Arm	350	200	41	591	75	264	None	6	345
LIVONIA	500	None	None	500	None	250	None	None	250
NORTHVILLE, CITY OF	300	None	None	300	150	175	10	None	335
NORTHVILLE TOWNSHIP	400	None	6	406	100	315	None	6	421
HOWL, CITY OF									
Huron Rouge Arm	755	None	5	760	200	280	7.50	None	487.50
Walled Lake Arm	672	None	5	677	200	280	7.50	None	487.50
PLYMOUTH TOWNSHIP	200	None	9	209	240	290	7.50	10	547.50
WALLED LAKE, CITY OF	100	1/	5	105	2/	300	None	5	305
WEST BLOOMFIELD TOWNSHIP									
Walnut Lake Arm	250	450	10	710	400	227	10	8	645
Morris Lake Arm	250	None	10	260	400	227	10	8	645
AVERAGE				524.07					435.04

1/ \$5 per mo. from August, 1971, to Connection Date -- Plus \$5 per mo. until debt is retired (billed quarterly).
 2/ \$8 per mo. until debt is retired (billed quarterly)

(Plus monthly charges)



TABLE A-4

SEWER AND WATER USE AND TAP FEES, 1974, FOR SELECTED
JURISDICTIONS IN METROPOLITAN DETROIT, MICHIGAN.

	SEWER				WATER				COMBINED TOTALS(\$)
	Use Charge(\$)	Use Charge(\$)	Inspection Charge(\$)	Total Charges(\$)	Use Charge(\$)	Tap Charge 1" Line(\$)	Const. Use Charge(\$)	Inspector Total Charge(\$)	
AVON TOWNSHIP	350	None	15	365	430	350	10	15	1,170
CLINTON TOWNSHIP	275	None	25	300	100	200	5.64	5	610.64
FARMINGTON HILLS									
13 Mile Arm	350	375	41	766	75	264	None	6	1,111
Tarabusi Arm	350	150	41	541	75	264	None	6	886
10 Mile Arm	350	980	41	1,371	75	264	None	6	1,716
Grand River Arm	350	200	41	591	75	264	None	6	936
LIVONIA	500	None	22	522	None	250	None	None	772
NORTHVILLE, CITY OF	300	None	None	300	150	175	10	None	635
NORTHVILLE TOWNSHIP	400	None	6	406	100	405	10	6	927
HOWL, CITY OF									
Buron Rouge Arm	791	None	5	796	200	295	7.50	None	1,298.50
Walled Lake Arm	708	None	5	713	308	295	7.50	None	1,363.50
PLYMOUTH TOWNSHIP	200	None	9	209	None	300	7.50	10	526.50
WALLED LAKE, CITY OF	360	300	10	670	1/	300	None	5	975
WEST BLOOMFIELD TOWNSHIP									(Plus monthly charges)
Walnut Lake Arm	250	475	10	735	400	257	20	8	1,420
Morris Lake Arm	250	None	10	260	400	257	20	8	945
Clinton-Oakland Arm	1,400	None	10	1,410	400	257	20	8	2,095
AVERAGE				622.19				464.51	1,086.70

1/: \$8 per month until debt is retired (billed quarterly).



APPENDIX B

ESTIMATED SUBDIVISION DEVELOPMENT COSTS FOR SELECTED
SITE SIZES, DETROIT, MICHIGAN, 1963 AND 1965-1976



APPENDIX B

ESTIMATED SUBDIVISION DEVELOPMENT COSTS FOR SELECTED SITE SIZES, DETROIT, MICHIGAN, 1963 AND 1965-1976

Robert H. Carey, President, Thompson-Brown Company was the primary individual responsible for collecting the data presented in Tables B-1 through B-16. While there are some difficulties with the data base because of changes in definitions and a few apparent inaccuracies, this time series is a quite unique data source. The data were calculated for each year and does not involve retrospective calculations. The articles for which the data was prepared appeared in a number of publications including the Michigan Buildor.

The text which accompanied the table for each year had extensive comments on the source and kinds of changes in each category cost. There was, however, some duplication from year to year. The significance of this data is in an aggregate form tracking the changes in costs faced by a single development firm over time. An effort was made to keep the categories of cost consistent from year to year.



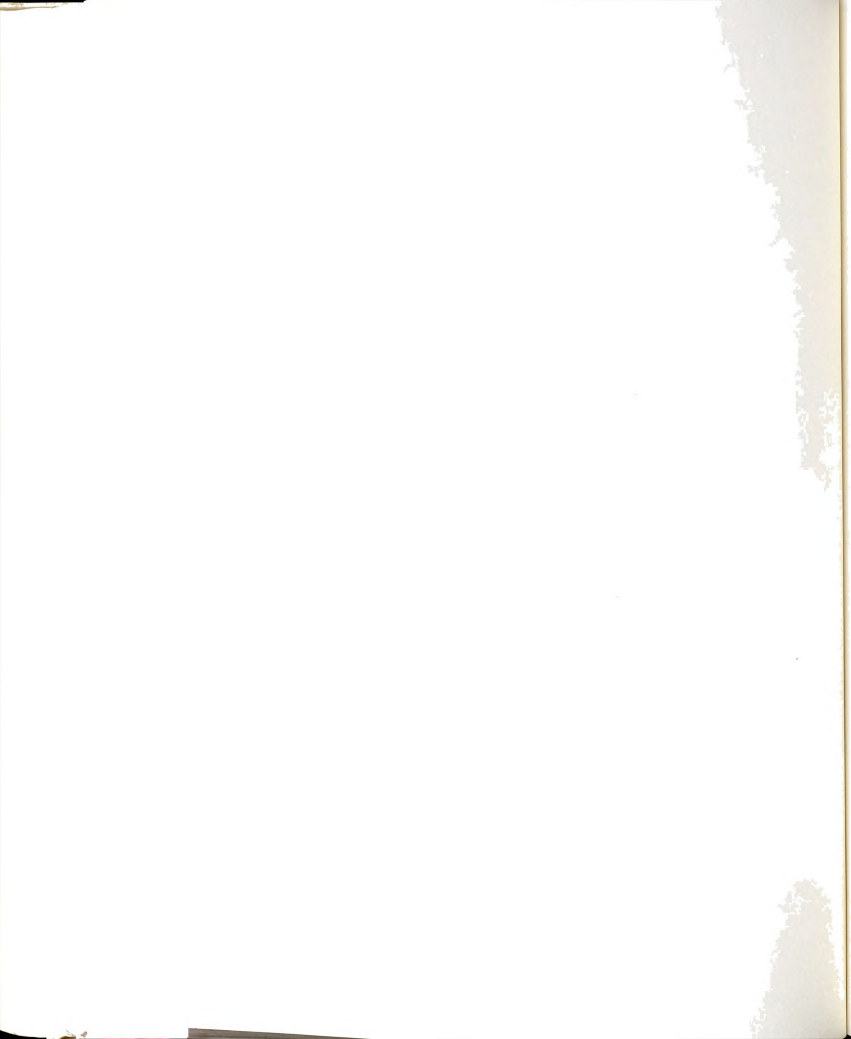


TABLE B-2

ESTIMATED SUBDIVISION DEVELOPMENT COSTS, 1963, FOR SELECTED SITE SIZES
WITH ASSUMED LAND COST OF \$5500 PER ACRE, DETROIT, MICHIGAN.

Lot Size (feet)	120' x 167'	100' x 150'	90' x 139'	75' x 120'	60' x 120'					
Lot Area (sq. feet)	20,000	15,000	12,500	9,000	7,200					
Lots per Acre	1.55	2.07	2.48	3.46	4.32					
	Per Lot(\$)	Per Front Foot(\$)	Per Lot(\$)	Per Front Foot(\$)	Per Lot(\$)					
Land	3448	29.57	2657	26.57	2218	24.64	1590	21.19	1273	21.21
Sewer System	955	7.95	876	8.76	815	9.06	730	9.74	660	11.00
Water System	742	6.17	614	6.14	550	6.11	450	6.00	345	5.75
Roads & Drainage	1005	8.38	760	7.60	585	6.50	625	8.34	525	8.75
Land Balance	150	1.25	175	1.75	200	2.22	215	2.87	225	3.75
Engineering incl. Planning & Inspection	285	2.38	242	2.42	215	2.39	202	2.69	176	2.94
Miscellaneous & Contingent	428	3.57	363	3.63	322	3.58	303	4.04	264	4.40
Cost of Money	948	7.90	759	7.59	654	7.27	549	7.32	462	7.70
Sales Cost	474	3.95	380	3.80	327	3.63	274	3.65	231	3.85
Overhead and Gross Profit	948	7.90	759	7.59	654	7.27	549	7.32	462	7.70
TOTALS	9483	79.02	7585	75.85	6540	72.67	5487	73.16	4623	77.05

Source: Data gathered, compiled and prepared by Robert H. Carey, President, Thompson-Brown Company, Detroit, Michigan.



TABLE B-2

ESTIMATED SUBDIVISION DEVELOPMENT COSTS, 1963. FOR SELECTED SITE SIZES
WITH ASSUMED LAND COST OF \$7000 PER ACRE. DETROIT, MICHIGAN.

Lot Size (feet)	120' x 167'	100 x 150'	90' x 139'	75' x 120'	60' x 120'
Lot Area (sq. feet)	20,000	15,000	12,500	9,000	7,200
Lots per Acre	1.55	2.07	2.48	3.46	4.32
	Per Lot(\$)	Per Lot(\$)	Per Lot(\$)	Per Lot(\$)	Per Lot(\$)
	Per Front Foot(\$)	Per Front Foot(\$)	Per Front Foot(\$)	Per Front Foot(\$)	Per Front Foot(\$)
Land	4516	3382	31.37	2023	1620
Sanitar System	955	876	9.06	730	660
Water System	742	614	6.11	450	395
Roads & Drainage	1005	760	6.50	625	525
Land Balance	150	175	2.22	215	225
Engineering Incl. Planning & Inspection	285	242	2.39	202	1176
Miscellaneous & Contingent	428	363	3.58	303	264
Cost of Money	1078	855	8.16	606	508
Sales Cost	539	427	4.08	303	254
Overhead and Gross Profit	1078	855	8.16	606	508
TOTALS	10776	8549	81.63	6063	5085

Source: Data gathered, compiled and prepared by Robert H. Carey, President, Thompson-Brown Company, Detroit, Michigan.



TABLE B-4

ESTIMATED SUBDIVISION DEVELOPMENT COSTS, 1965, FOR SELECTED SITE SIZES
WITH ASSUMED LAND COST OF \$4000 PER ACRE, DETROIT, MICHIGAN.

Lot Size (feet)	120' x 167'	100' x 150'	90' x 139'	90' x 120'	75' x 120'	60' x 120'
Lot Area (sq. foot)	20,000	15,000	12,500	10,800	9,000	7,200
Lots per Acre	1.55	2.07	2.48	2.80	3.46	4.32
	Per Lot (\$)	Per Front Foot (\$)	Per Lot (\$)	Per Front Foot (\$)	Per Lot (\$)	Per Front Foot (\$)
Land	2581	21.51	19.32	17.92	15.88	15.41
Sewer System	962	8.02	8.80	9.12	9.12	10.07
Water System	742	6.17	6.14	6.11	6.05	6.00
Roads & Drainage	1206	10.05	9.95	9.90	9.83	9.50
Land Balance	150	1.25	1.75	2.22	2.28	2.87
Engineering incl. Planning & Inspection	306	2.55	2.66	2.73	2.73	3.02
Miscellaneous & Contingent	495	4.13	4.40	4.51	4.50	4.97
Cost of Money	859	7.16	7.07	7.00	6.72	7.13
Sales Cost	429	3.58	3.53	3.51	3.36	3.41
Overhead and Gross Profit	859	7.16	7.07	7.00	6.72	7.13
TOTALS	8589	71.50	70.69	70.02	67.19	71.39

Source: Data gathered, compiled and prepared by Robert H. Carey, President, Thompson-Brown Company, Detroit, Michigan.



TABLE B-5

ESTIMATED SUBDIVISION DEVELOPMENT COSTS, 1966, FOR SELECTED SITE SIZES
WITH ASSUMED LAND COST OF \$1000 PER ACRE, DETROIT, MICHIGAN.

Lot Size (feet)	120' x 167'	100' x 150'	90' x 139'	90' x 120'	75' x 120'	60' x 120'
Lot Area (sq. feet)	20,000	15,000	12,500	10,800	9,000	7,200
Lots per Acre	1.55	2.07	2.48	2.80	3.46	4.32
	Per Lot (\$)	Per Lot (\$)	Per Lot (\$)	Per Lot (\$)	Per Lot (\$)	Per Lot (\$)
	Per Front Foot (\$)	Per Front Foot (\$)	Per Front Foot (\$)	Per Front Foot (\$)	Per Front Foot (\$)	Per Front Foot (\$)
Land	2581	1932	1613	1429	1156	926
Sewer System	1116	1021	952	952	876	803
Water System	831	688	616	612	504	385
Roads & Drainage	1367	1194	1114	1142	926	710
Land Balance	165	197	220	225	236	247
Engineering Incl. Planning & Inspection	350	310	290	293	294	215
Miscellaneous & Contingent	577	511	479	484	419	354
Cost of Money	934	780	704	685	583	485
Salon Cost	467	390	352	342	291	242
Overhead and Gross Profit	934	780	704	685	583	485
TOTALS	9342	7803	7044	6849	5828	4853
Percent Increase over 1965	8.8%	10.4%	11.8%	12.3%	13.5%	12.3%
	Average Increase 11.5% from 1965 costs.					

Source: Data gathered, compiled and prepared by Robert H. Carey, President, Thompson-Brown Company, Detroit, Michigan.



TABLE B-6

ESTIMATED SUBDIVISION DEVELOPMENT COSTS, 1967, FOR SELECTED SITE SIZES
WITH ASSUMED LAND COST OF \$1,000 PER ACRE, DETROIT, MICHIGAN.

Lot Size (feet)	120' x 167'	100' x 150'	90' x 139'	90' x 120'	75' x 120'	60' x 120'
Lot Area (sq. feet)	20,000	15,000	12,500	10,800	9,000	7,200
Lots per Acre	1.55	2.07	2.48	2.80	3.46	4.32
	Per Lot (\$)	Per Lot (\$)	Per Lot (\$)	Per Lot (\$)	Per Lot (\$)	Per Lot (\$)
	Per Front Foot (\$)	Per Front Foot (\$)	Per Front Foot (\$)	Per Front Foot (\$)	Per Front Foot (\$)	Per Front Foot (\$)
Land	2581	1932	1613	1429	1156	926
Sewer System 13%	1283	1174	1095	1095	1007	923
Water System 16%	914	757	678	673	554	425
Roads & Drainage 10%	1526	1313	1225	1256	1019	781
Land Balance 20%	193	236	264	270	283	296
Engineering incl. Planning & Inspection	392	348	326	329	286	243
Miscellaneous & Contingent	648	575	538	543	472	400
Cost of Money	1005	844	765	746	637	532
Sales Cost	503	422	383	373	318	267
Overhead and Gross Profit	1005	844	765	746	637	532
TOTALS	10055	8445	7652	7460	6369	5325
Percent Increase over 1966	7.6%	8.2%	8.6%	8.19%	9.3%	9.7%
			Average Increase			

Source: Data gathered, compiled and prepared by Robert H. Carey, President, Thompson-Brown Company, Detroit, Michigan.



TABLE B-7

ESTIMATED SUBDIVISION DEVELOPMENT COSTS, 1960, FOR SELECTED SITE SIZES
WITH ASSUMED LAND COST OF \$4,000 PER ACRE, DETROIT, MICHIGAN.

Lot Size (feet)	120' x 167'	100' x 150'	90' x 139'	90' x 120'	75' x 120'	60' x 120'					
Lot Area (sq. feet)	20,000	15,000	12,500	10,800	9,000	7,200					
Lots per Acre	1.55	2.07	2.48	2.80	3.46	4.32					
	Per Lot(\$)	Per Front Foot(\$)	Per Lot(\$)	Per Front Foot(\$)	Per Lot(\$)	Per Front Foot(\$)					
Land	2581	21.51	19.32	1613	17.92	1429	15.88	1165	15.41	926	15.43
Sewer System 10%	1065	8.87	9.45	860	9.56	860	9.56	761	10.15	670	11.17
Water System 10%	1005	8.37	8.33	746	8.29	740	8.22	609	8.12	468	7.80
Roads & Drainage 2%	1880	15.67	16.15	1510	16.78	1545	17.17	1253	16.71	961	16.02
Land Balance 5%	208	1.73	2.48	296	3.31	283	3.14	297	3.96	311	5.18
Engineering incl. Planning & Inspection 10%	457	3.81	4.01	376	4.18	377	4.19	321	4.28	265	4.42
Miscellaneous & Contingent	692	5.77	6.06	569	6.32	571	6.34	486	5.48	401	6.68
Cost of Money	1052	8.77	8.77	796	8.84	774	8.80	651	6.68	534	8.90
Salon Cost	526	4.38	4.39	398	4.42	387	4.30	326	4.34	267	4.45
Overhead and Gross Profit	1052	8.77	8.77	796	8.84	774	8.60	651	8.68	534	8.90
Totals	10518	87.65	87.73	7962	88.46	7740	86.00	6511	86.81	5337	89.95
Percent Increase over 1967	8.0%	7.9%	8.5%	8.3%	7.5%	6.3%					
Average Increase	7.8%										

Source: Data gathered, compiled and prepared by Robert H. Carey, President, Thompson-Brown Company, Detroit, Michigan.

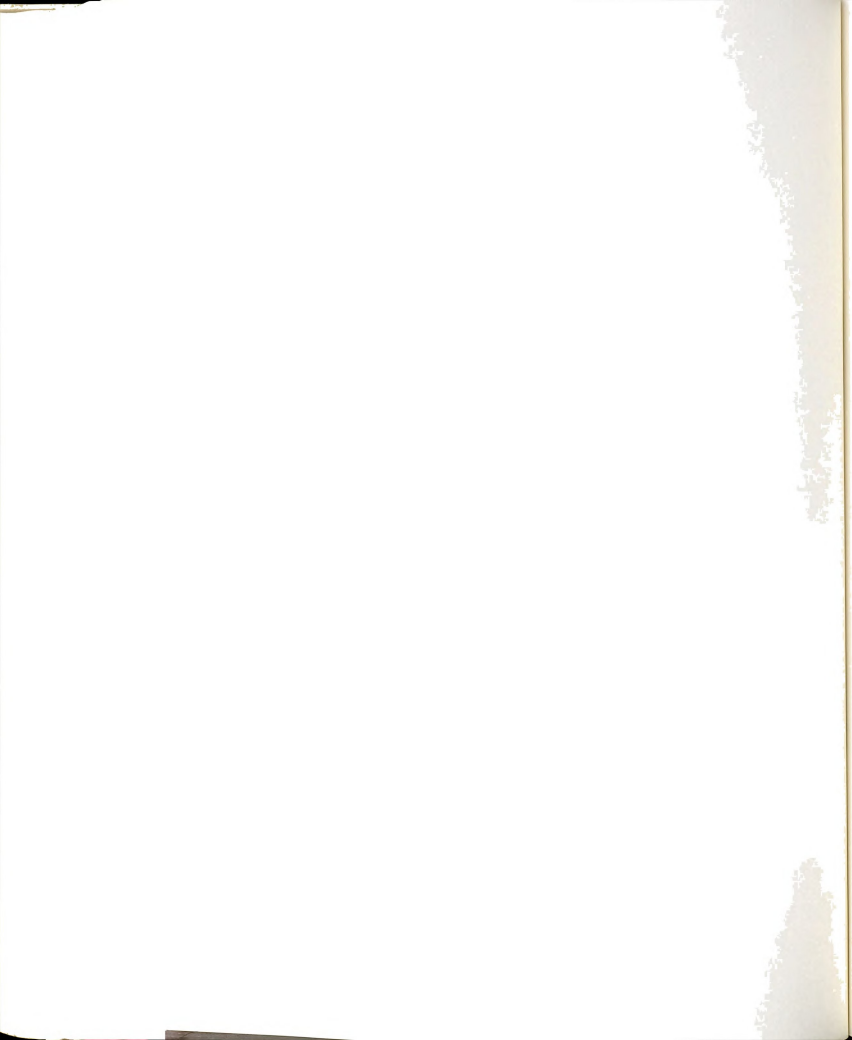


TABLE B-8

ESTIMATED SUBDIVISION DEVELOPMENT COSTS, 1969, FOR SELECTED SITE SIZES
WITH ASSUMED LAND COST OF \$5000 PER ACRE, DETROIT, MICHIGAN.

Lot Size (feet)	120' x 167'	100' x 150'	90' x 139'	90' x 120'	75' x 120'	60' x 120'
Lot Area (sq. feet)	20,000	15,000	12,500	10,800	9,000	7,200
Lots Per Acre	1.55	2.07	2.48	2.80	3.45	4.32
	Per Lot (\$)	Per Lot (\$)	Per Lot (\$)	Per Lot (\$)	Per Lot (\$)	Per Lot (\$)
	Per Front Foot (\$)	Per Front Foot (\$)	Per Front Foot (\$)	Per Front Foot (\$)	Per Front Foot (\$)	Per Front Foot (\$)
Land	3226.	2415.	2016.	1786.	1449.	1157.
Sewer System	1465.	1300.	1175.	1184.	960.	774.
Water System	1005.	833.	729.	720.	574.	427.
Roads & Drainage	2208.	1900.	1764.	1816.	1556.	1260.
Land Balance	222.	260.	313.	343.	297.	240.
Engineering Incl. Planning & Inspection	539.	472.	438.	447.	371.	297.
Miscellaneous & Contingent	815.	715.	664.	677.	564.	450.
Cost of money, Sales cost & overhead & Gross Profit	5105.	4251.	3822.	3755.	3108.	2480.
TOTALS	14585.	12146.	10921.	10728.	8881.	7085.

Source: Data gathered, compiled and prepared by Robert H. Carey, President, Thompson-Brown Company, Detroit, Michigan.

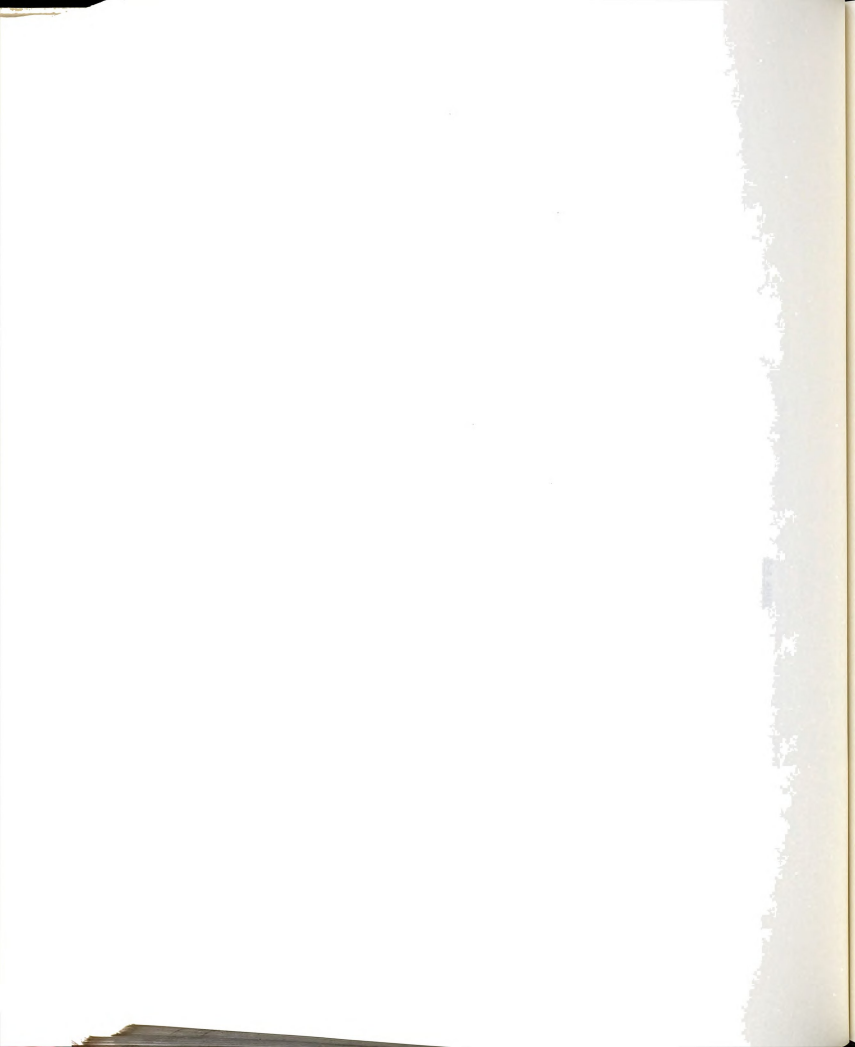


TABLE B-2

ESTIMATED SUBDIVISION DEVELOPMENT COSTS, 1970, FOR SELECTED SITE SIZES
WITH ASSUMED LAND COST OF \$5,000 PER ACRE, DETROIT, MICHIGAN.

Lot Size (feet)	120' x 167'	100' x 150'	90' x 139'	90' x 120'	75' x 120'	60' x 120'
Lot Area (sq. feet)	20,000	15,000	12,500	10,800	9,000	7,200
Lots Per Acre	1.55	2.07	2.48	2.80	3.45	4.32
	Per Lot (\$)	Per Front Foot (\$)	Per Lot (\$)	Per Front Foot (\$)	Per Lot (\$)	Per Front Foot (\$)
Land	3226.	26.88	24.15	2016.	1786.	19.32
Sewer System	1465.	12.21	13.00	1184.	960.	774.
Water System	1005.	8.37	8.33	729.	574.	427.
Roads & Drainage	2318.	19.32	19.95	1852.	1634.	1323.
Land Balance	222.	1.85	2.60	313.	297.	240.
Engineering incl. Planning & Inspection	601.	5.01	5.27	488.	416.	332.
Miscellaneous & Contingent	842.	7.01	7.37	684.	582.	464.
Cost of money, Sales cost & overhead & Gross Profit	5211.	43.43	43.43	3908.	3183.	2450.
TOTALS	14890.	124.08	124.10	11165.	9095.	7257.
Percent Increase over 1969	2.1%	2.2%	2.2%	2.3%	2.4%	2.4%
	Average Increase 2.3% from 1969 costs.					

Source: Data gathered, compiled and prepared by Robert H. Carey, President, Thompson-Brown Company, Detroit, Michigan.

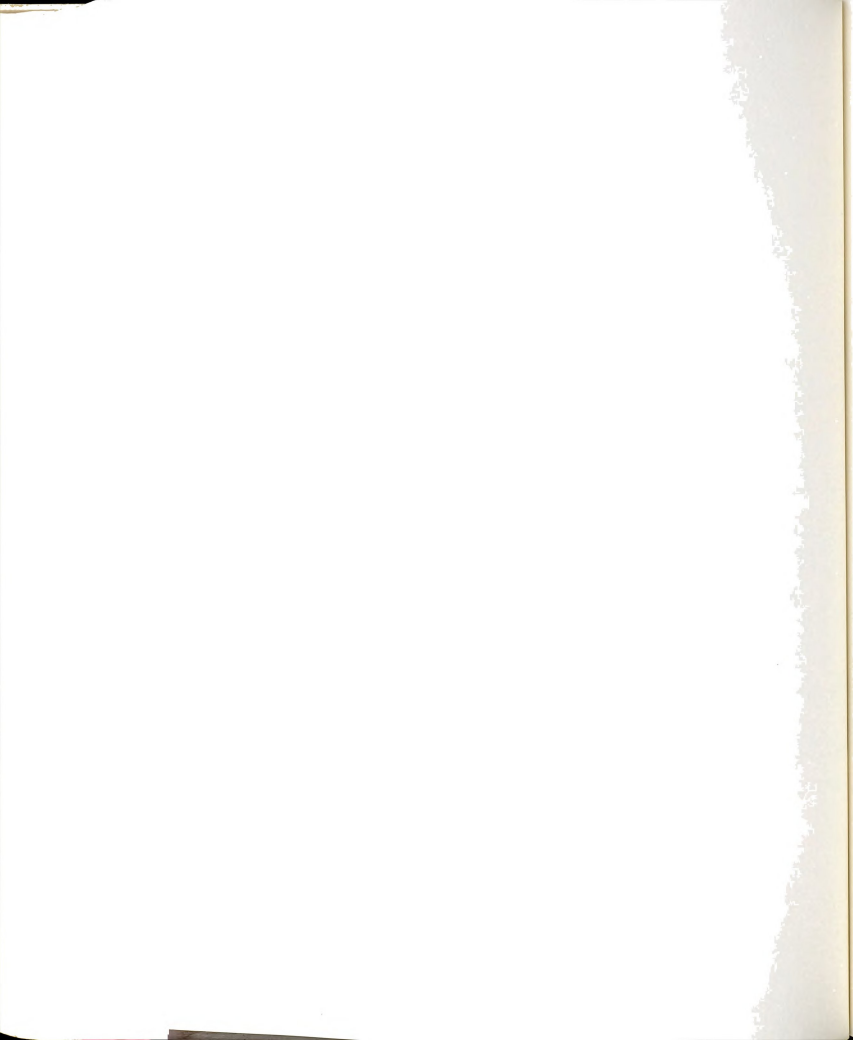


TABLE B-10

ESTIMATED SUBDIVISION DEVELOPMENT COSTS, 1970, FOR SELECTED SITE SIZES
WITH ASSUMED LAND COST OF \$5,000 PER ACRE, DETROIT, MICHIGAN.¹

Lot Size (feet)	120' x 167'	100' x 150'	90' x 139'	90' x 120'	75' x 120'	60' x 120'
Lot Area (sq. feet)	20,000	15,000	12,500	10,800	9,000	7,200
Lots per Acre	1.55	2.07	2.48	2.80	3.45	4.32
	Per Lot (\$)	Per Front Foot (\$)	Per Lot (\$)	Per Front Foot (\$)	Per Lot (\$)	Per Front Foot (\$)
Land	3226.	2415.	2016.	1786.	1449.	1157.
Sewer System	1608.	1427.	1290.	1300.	1051.	849.
Water System	1104.	914.	800.	791.	630.	469.
Roads & Drainage	2345.	2018.	1873.	1929.	1652.	1338.
Land Balance	240.	281.	338.	370.	321.	259.
Engineering incl. Planning & Inspection	636.	556.	516.	527.	439.	350.
Miscellaneous & Contingent	890.	780.	723.	736.	614.	490.
Cost of money, Sales cost & overhead & Gross Profit	5410.	4518.	4068.	4006.	3316.	2645.
TOTALS	15457.	12909.	11624.	11447.	9475.	7557.
						125.96

Source: Data gathered, compiled and prepared by Robert H. Carey, President, Thompson-Brown Company, Detroit, Michigan.

¹What would have been under normal conditions.



TABLE B-11

ESTIMATED SUBDIVISION DEVELOPMENT COSTS, 1971, FOR SELECTED SITE SIZES
WITH ASSUMED LAND COST OF \$5,000 PER ACRE, DETROIT, MICHIGAN.

Lot Size (feet)	120' x 167'	100' x 150'	90' x 139'	90' x 120'	75' x 120'	60' x 120'
Lot Area (sq. feet)	20,000	15,000	12,500	10,800	9,000	7,200
Lots Per Acre	1.55	2.07	2.48	2.80	3.45	4.22
	Per Lot (\$)	Per Front Foot (\$)	Per Lot (\$)	Per Front Foot (\$)	Per Lot (\$)	Per Front Foot (\$)
Land	3226.	26.88	24.15	2016.	1786.	19.84
Sewer System	1611.	13.42	14.30	1293.	1302.	14.47
Water System	1106.	9.22	9.16	802.	792.	8.80
Roads & Drainage	2550.	21.25	21.95	2037.	2098.	23.31
Land Balance	266.	2.22	3.12	375.	412.	4.58
Engineering, including Planning & Inspection	664.	5.53	5.82	541.	552.	6.13
Miscellaneous & Contingent	930.	7.75	8.15	757.	773.	8.59
Cost of Money, Sales Cost and Overhead and Gross Profit	5575.	46.46	46.66	4211.	46.79	46.16
TOTALS	15928.	132.73	133.31	12032.	11869.	131.88
Percent Increase over 1970	7.0%	7.4%	7.8%	8.1%	8.2%	8.2%
Average Increase 7.8% from 1970 Costs.						

Source: Data gathered, compiled and prepared by Robert H. Carey, President, Thompson-Brown Company, Detroit, Michigan.



TABLE B-12

ESTIMATED SUBDIVISION DEVELOPMENT COSTS, 1972. FOR SELECTED SITE SIZES
WITH ASSUMED LAND COST OF \$5,000 PER ACRE, DETROIT MICHIGAN.

Lot Size (feet)	120' x 167'	100' x 150'	90' x 139'	90' x 120'	75' x 120'	60' x 120'
Lot Area (sq. feet)	20,000	15,000	12,500	10,800	9,000	7,200
Lots Per Acre	1.55	2.07	2.48	2.80	3.45	4.32
	Per Lot (\$)	Per Lot (\$)	Per Lot (\$)	Per Lot (\$)	Per Lot (\$)	Per Lot (\$)
	Per Front Foot (\$)	Per Front Foot (\$)	Per Front Foot (\$)	Per Front Foot (\$)	Per Front Foot (\$)	Per Front Foot (\$)
Land	3226.	2415.	2016.	1786.	1449.	1157.
Sewer System	1675.	1487.	1345.	1194.	1098.	885.
Water System	1150.	953.	834.	824.	656.	489.
Roads & Drainage	2652.	2283.	2118.	2182.	1869.	1513.
Land Balance	285.	334.	401.	441.	381.	308.
Engineering, Including Planning & Inspection	691.	607.	564.	576.	481.	383.
Miscellaneous & Contingent	968.	849.	789.	806.	673.	537.
Cost of Money, Sales Cost & Overhead & Gross Profit	5733.	4807.	4344.	4291.	3557.	3839.
TOTALS	16380.	13735.	12411.	12260.	10164.	8111.
Percent Increase over 1971	2.9%	3.0%	3.1%	3.3%	3.3%	3.3%
	Average Increase 3.1% from 1971 Costs.					

Source: Data gathered, compiled and prepared by Robert H. Carey, President, Thompson-Brown Company, Detroit, Michigan.

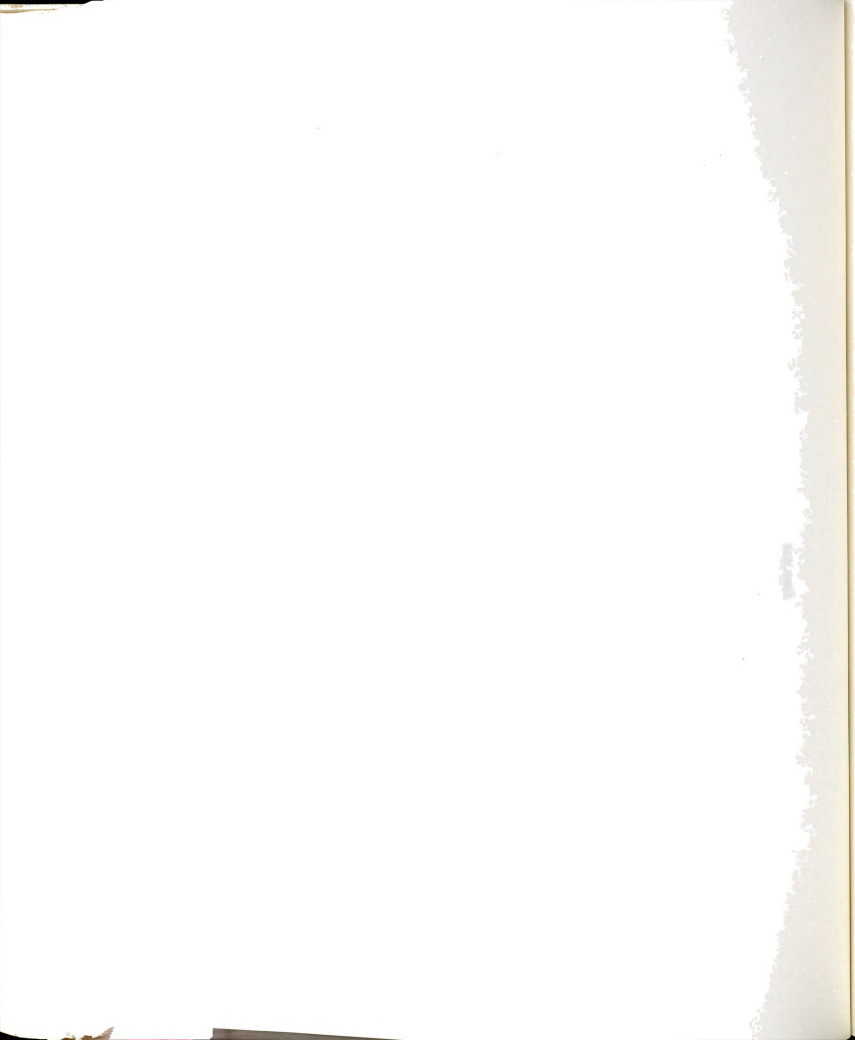


TABLE B-13

ESTIMATED SUBDIVISION DEVELOPMENT COSTS, 1973, FOR SELECTED SITE SIZES
WITH ASSUMED LAND COST OF \$6,000 PER ACRE, DETROIT, MICHIGAN.

Lot Size (feet.)	120' x 167'	100' x 150'	90' x 139'	90' x 120'	75' x 120'	60' x 120'
Lot Area (sq. feet)	20,000	15,000	12,500	10,800	9,000	7,200
Lots Per Acre	1.55	2.07	2.48	2.80	3.45	4.32
	Per Lot (\$)	Per Lot (\$)	Per Lot (\$)	Per Lot (\$)	Per Lot (\$)	Per Lot (\$)
	Per Front Foot (\$)	Per Front Foot (\$)	Per Front Foot (\$)	Per Front Foot (\$)	Per Front Foot (\$)	Per Front Foot (\$)
Land	3871.	2899.	2419.	2143.	1739.	1389.
	32.26	28.99	26.88	23.81	23.19	23.15
Sewer System	1792.	1591.	1438.	1449.	1175.	947.
	14.93	15.91	15.99	16.10	15.67	15.78
Water System	1219.	1010.	884.	873.	695.	518.
	10.16	10.10	9.82	9.70	9.27	8.63
Roads & Drainage	2811.	2420.	2245.	2313.	1981.	1604.
	23.43	24.20	24.94	25.70	26.41	26.73
Land Balance	311.	364.	437.	481.	415.	336.
	2.59	3.64	4.86	5.34	5.53	5.60
Engineering, Including Planning & Inspection	859.	754.	701.	716.	597.	477.
	7.16	7.54	7.79	7.96	7.96	7.95
Miscellaneous & Contingent	1419.	921.	856.	875.	729.	582.
	8.74	9.21	9.51	9.72	9.72	9.70
Cost of Money, Sales Cost & Overhead & Gross Profit	6414.	5363.	4836.	4765.	3947.	3152.
	53.45	53.63	53.73	52.95	52.63	52.53
TOTALS	18326.	15322.	13817.	13615.	11278.	9005.
	152.72	153.22	153.52	151.28	150.38	150.08
Percent Increase over 1972	11.9% ¹	11.3% ¹	11.0% ¹	10.9% ¹	11.0% ¹	6.6% ²
	5.8% ²	6.1% ²	6.3% ²	6.6% ²	6.6% ²	6.6% ²
	Average Increase (11.27%) ¹ (6.3%) ²					

Source: Data gathered, compiled and prepared by Robert H. Carey, President, Thompson-Brown Company, Detroit, Michigan.

¹ Includes 20% Increase in Land Cost.

² Based on \$5,000/acre Land Costs.

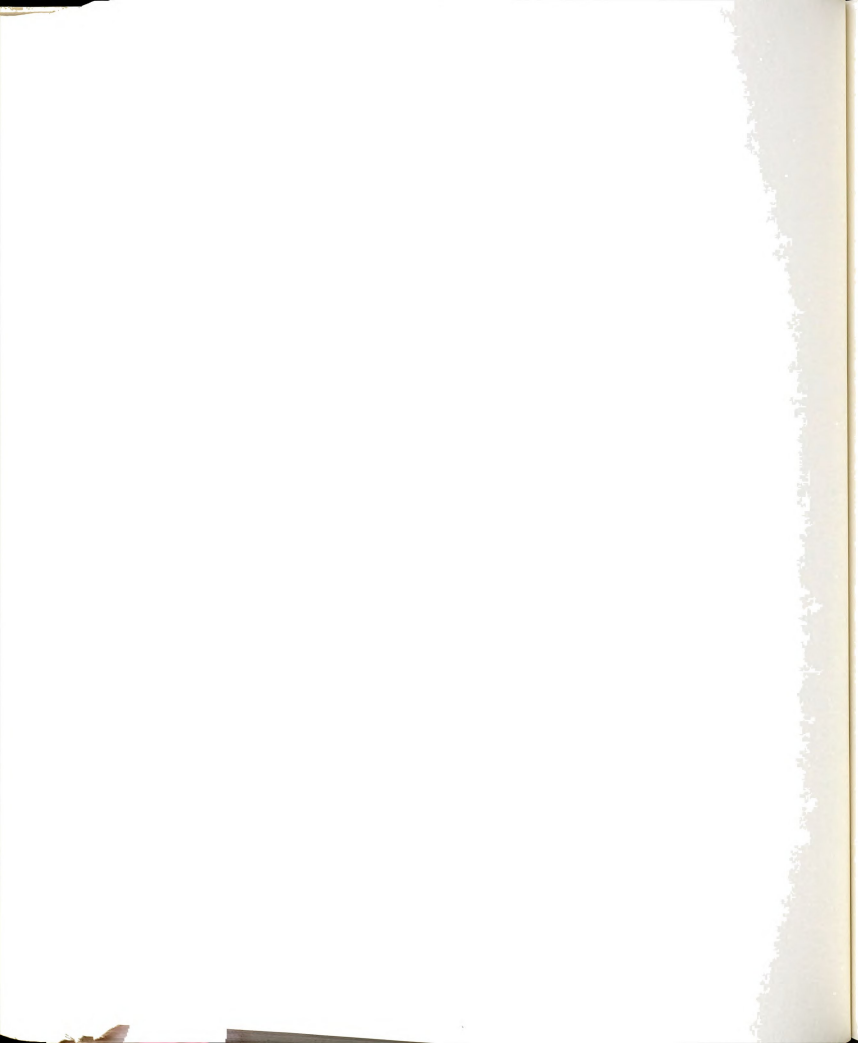


TABLE B-14

ESTIMATED SUBDIVISION DEVELOPMENT COSTS, 1974, FOR SELECTED SITE SIZES
WITH ASSUMED LAND COST OF \$6,000 PER ACRE, DETROIT, MICHIGAN.

Lot Size (feet)	120' x 167'	100' x 150'	90' x 139'	90' x 120'	75' x 120'	60' x 120'
Lot Area (sq. feet)	20,000	15,000	12,500	10,800	9,000	7,200
Lots Per Acre	1.55	2.07	2.48	2.80	3.45	4.32
	Per Lot (\$)	Per Front Foot (\$)	Per Lot (\$)	Per Front Foot (\$)	Per Lot (\$)	Per Front Foot (\$)
Land	3871.	2899.	2419.	2143.	1739.	1389.
Sewer System	1917.	1702.	1540.	1550.	1257.	1013.
Water System	1377.	1141.	999.	986.	785.	585.
Roads & Drainage	3345.	2880.	2672.	2752.	2357.	1909.
Land Balance	373.	437.	524.	577.	498.	403.
Engineering, Including Planning & Inspection	1122.	986.	918.	938.	783.	626.
Miscellaneous & Contingent	1220.	1072.	998.	1020.	852.	380.
Cost of Money, Sales Cost & Overhead & Gross Profit	7121.	5986.	5422.	5366.	4451.	3557.
TOTALS	20346.	17103.	15492.	15332.	12725.	10162.
Percent Increase over 1973	11.0%	11.6%	12.1%	12.6%	12.8%	12.8%
	Average Increase 12.15%					

Source: Data gathered, compiled and prepared by Robert H. Carey, President, Thompson-Brown Company, Detroit, Michigan.

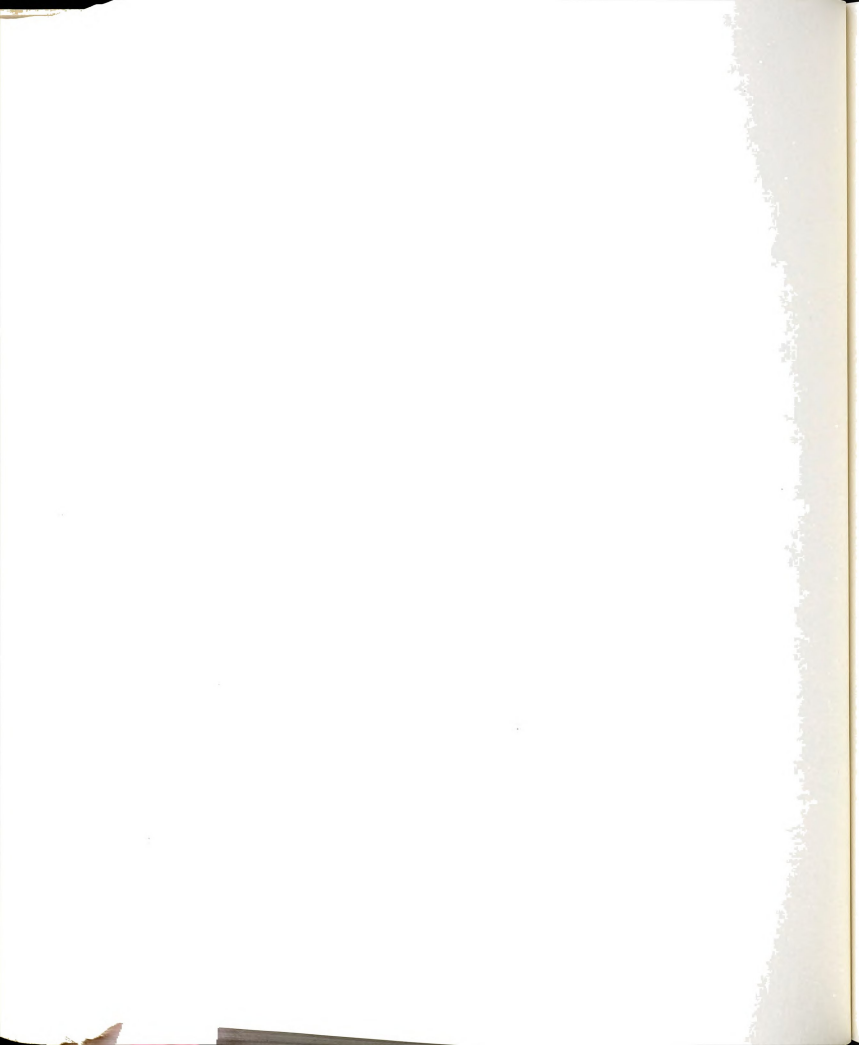


TABLE B-15

ESTIMATED SUBDIVISION DEVELOPMENT COSTS, 1975, FOR SELECTED SITE SIZES
WITH ASSUMED LAND COST OF \$6,000 PER ACRE, DETROIT, MICHIGAN.

Lot Size (feet)	120' x 167'	100' x 150'	90' x 139'	90' x 120'	75' x 120'	60' x 120'
Lot Area (sq. feet)	20,000	15,000	12,500	10,800	9,000	7,200
Lots Per Acre	1.55	2.07	2.48	2.80	3.45	4.32
Land	Per Lot (\$)	Per Front Foot (\$)	Per Lot (\$)	Per Front Foot (\$)	Per Lot (\$)	Per Front Foot (\$)
Sanitary Sewers	3871.	2899.	2419.	2143.	1739.	1389.
Water Mains	1974.	1753.	1586.	1596.	1295.	1013.
Paved Roads, Storm Drains & Drainage	1432.	1186.	1039.	1025.	816.	608.
Clearing, Grading, Land Balance & Soil Erosion Controls	4047.	3485.	3233.	3330.	2852.	2310.
Planning, Surveying, Engineering and Municipal Review & Inspection Fees	395.	463.	555.	612.	528.	427.
Miscellaneous & Contingent	1256.	1102.	1026.	1050.	878.	702.
Cost of Money, Sales Cost & Overhead & Gross Profit	1365.	1198.	1116.	1142.	955.	763.
ESTIMATED AVERAGE SALES PRICE	7722.	6508.	5908.	5868.	4880.	3899.
Percent Increase over 1974	22062.	18594.	16882.	16766.	13943.	11141.
	8.4%	8.7%	9.0%	9.4%	9.6%	9.6%

Source: Data gathered, compiled and prepared by Roy J. Russell, P.E., Consulting Engineer, Planner & Surveyor, 32823 Twelve Mile Road, Farmington Hills, Michigan.

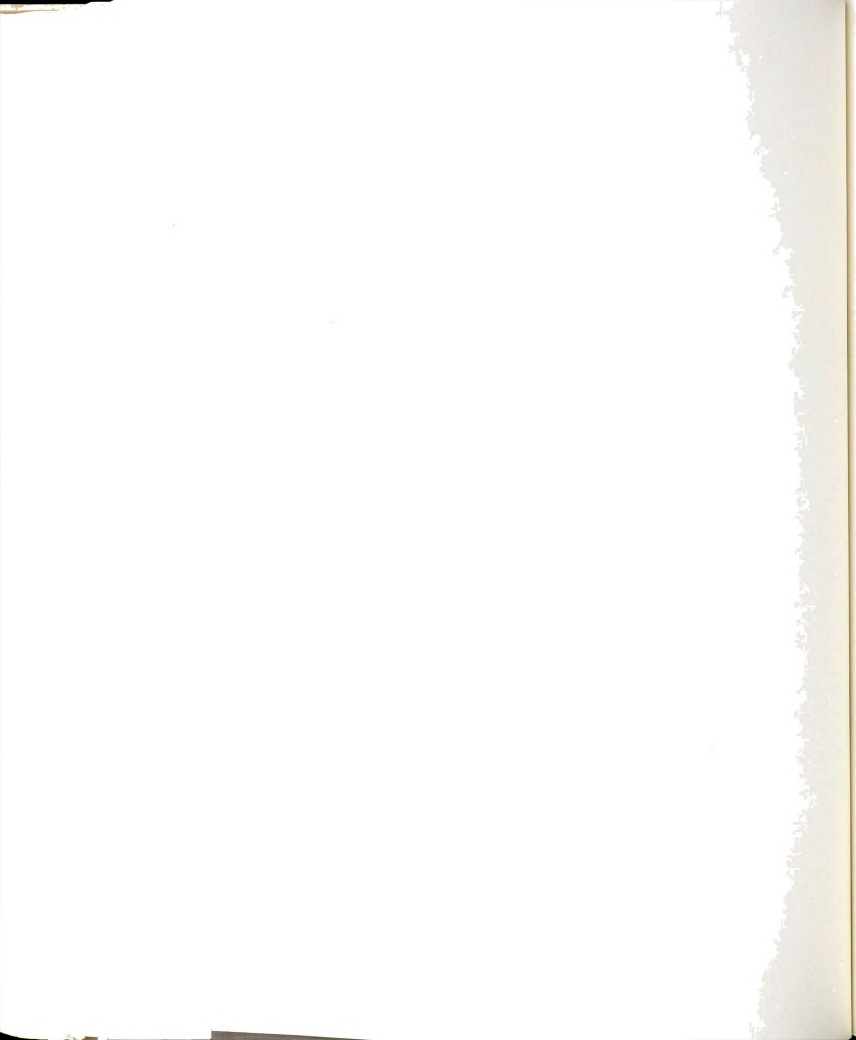


TABLE B-16

ESTIMATED SUBDIVISION DEVELOPMENT COSTS, 1976, FOR SELECTED SITE SIZES
WITH ASSUMED LAND COST OF \$6,000 PER ACRE, DETROIT, MICHIGAN.

Lot Size (feet)	120' x 167'	100' x 150'	90' x 139'	90' x 120'	75' x 120'	60' x 120'				
Lot Area (sq. feet)	20,000	15,000	12,500	10,800	9,000	7,200				
Lots Per Acre	1.55	2.07	2.48	2.80	3.45	4.32				
	<u>Per Lot (\$)</u>	<u>Per Front Foot (\$)</u>	<u>Per Lot (\$)</u>	<u>Per Front Foot (\$)</u>	<u>Per Lot (\$)</u>	<u>Per Front Foot (\$)</u>				
Land	3871.	32.26	2419.	26.88	2143.	23.81	1739.	23.19	1389.	23.15
Sanitary Sewers	2072.	17.27	1665.	18.50	1676.	18.62	1359.	18.12	1095.	18.25
Water Mains	1504.	12.53	1091.	12.12	1076.	11.96	857.	11.42	638.	10.64
Paved Roads, Storm Drains & Drainage.	4370.	36.42	3491.	38.79	3596.	39.96	3080	41.06	2495.	41.58
Clearing, Grading, Land Balance & Soil Erosion Controls	434.	3.62	611.	6.79	673.	7.48	581.	7.74	470.	7.83
Planning, Surveying, Engineering and Municipal Review & Inspection Fees	1341.	11.17	1097.	12.19	1123.	12.48	940.	12.53	752.	12.53
Miscellaneous & Contingent	1653.	13.77	1353.	15.03	1385.	15.39	1157.	15.45	926.	15.44
Cost of Money, Sales Cost & Overhead & Gross Profit	8209.	68.41	6314.	70.16	6286.	69.84	5231.	69.74	4181.	69.69
ESTIMATED AVERAGE SALES PRICE	23454.	195.45	18041.	200.46	17958.	199.54	14944.	199.25	11946.	199.11
Percent Increase over 1975	6.3%		6.6%	6.9%	7.1%	7.2%	7.2%		7.2%	
	Average Increase 6.9% from 1975 costs.									

Source: Data gathered, compiled and prepared by Roy J. Russell, P.E., Consulting Engineer, Planner and Surveyor,
32423 Twelve Mile Road, Farmington Hills, Michigan.



APPENDIX C

CALCULATED AGRICULTURAL OPPORTUNITY COSTS



APPENDIX C

CALCULATED AGRICULTURAL OPPORTUNITY COSTS

Table C-1 contrasts the calculated agricultural opportunity costs and USDA data on the value of agricultural land and buildings. The calculation of agricultural opportunity costs involved an examination of the National Atlas of the United States (U.S. Geological Survey, 1970) on a county basis within states to find counties having similar agricultural land uses to those counties undergoing urban pressures were listed and averaged by states. In a few instances prior knowledge by the author and fellow graduate students supplemented the process. These counties served as the base for the calculated agricultural opportunity costs for 1959, 1964, and 1974.

elder

1881

multistellar

1882

1883

1884

1885

1886

1887

1888

TABLE C-1

CALCULATED AGRICULTURAL OPPORTUNITY COSTS AND
VALUE OF AGRICULTURAL LAND AND BUILDINGS, 1969.

State	Calculated Agricultural Opportunity Costs (\$ per acre)	Value of Agricul- tural Land and Buildings (\$ per acre)
Alabama	214.	187.
Alaska	---	---
Arizona	157.	67.
Arkansas	316.	246.
California	524.	487.
Colorado	95.	92.
Connecticut	859.	863.
Delaware	399.	457.
Florida	318.	319.
Georgia	254.	214.
Hawaii	---	---
Idaho	232.	168.
Illinois	470.	493.
Indiana	401.	417.
Iowa	430.	382.
Kansas	182.	162.
Kentucky	257.	238.
Louisiana	380.	302.
Maine	222.	150.
Maryland	490.	578.
Massachusetts	469.	514.
Michigan	299.	316.
Minnesota	327.	216.
Mississippi	255.	221.
Missouri	241.	217.
Montana	103.	56.
Nebraska	294.	150.
Nevada	197.	50.
New Hampshire	270.	218.
New Jersey	737.	968.
New Mexico	81.	41.
New York	299.	250.
North Carolina	328.	337.
North Dakota	130.	91.
Ohio	391.	378.
Oklahoma	218.	162.
Oregon	406.	143.
Pennsylvania	282.	326.
Rhode Island	549.	684.

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TABLE C-1 (continued)

South Carolina	260.	259.
South Dakota	154.	83.
Tennessee	282.	252.
Texas	196.	142.
Utah	187.	88.
Vermont	258.	198.
Virginia	330.	258.
Washington	253.	215.
West Virginia	139.	127.
Wisconsin	327.	213.
Wyoming	73.	38.

Source: Calculated Agricultural Opportunity Costs from 1969 Census of Agriculture. Value of Agricultural Land and Buildings from Farm Real Estate Historical Series.

South Dakota
Nebraska
Kansas
Oklahoma
Texas
Arkansas
Louisiana
Mississippi
Alabama
Georgia
Florida
South Carolina
North Carolina
Virginia
Maryland
Delaware
Pennsylvania
New Jersey
New York
Connecticut
Rhode Island
Massachusetts
Vermont
New Hampshire
Maine
Hawaii

Alaska

APPENDIX D

COMPARATIVE CASE STUDY INTERVIEW QUESTIONS



APPENDIX D

COMPARATIVE CASE STUDY INTERVIEW QUESTIONS

Twenty developers, planners, and sundry other local government officials were interviewed in the Lansing, Kalamazoo, and Jackson, Michigan areas. The developer interviews were confidential and loosely structured around the questions listed below. These interviews followed examination of zoning maps and ordinances as well as other planning documents and census data. The process was iterative, involving telephone contacts with additional questions and issues raised by other interviews.

General:

1. How long have you been a developer here?
2. What is the typical number of lots you've developed per year for the last five years?
3. What jurisdictions?
4. What kind of housing?

Land:

5. What is the average price per acre of raw land you've bought over the last five years? average____ high____ low____
6. What would you expect to pay for land this year?
7. How important is the price of raw land to your location decision? Explain.
8. How large are the lots you develop? average____ large____ small____
9. On the average what are your development costs per lot?

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10. What do finished lots go for?

11. What do you think is the percent attributable to land? Has it risen?

12. What are the size (variation) of tracks of raw land you have purchased for residential development?

13. Are there land availability problems?

Zoning:

14. Does zoning affect where you build? How?

15. How does zoning affect your cost of doing business? Vary over jurisdictions?

16. How easy (by jurisdiction) is it to get zoning changes for residential and multiple family?

17. What do you think of the consistency of zoning decisions in jurisdictions you are familiar with?

18. Are there jurisdictions where building anything other than low density residential is difficult? Which?

19. How does zoning lot size (etc.) requirements affect the size of the lot you build upon? Do you always build on larger lots anyway? What is the most important zoning constraint?

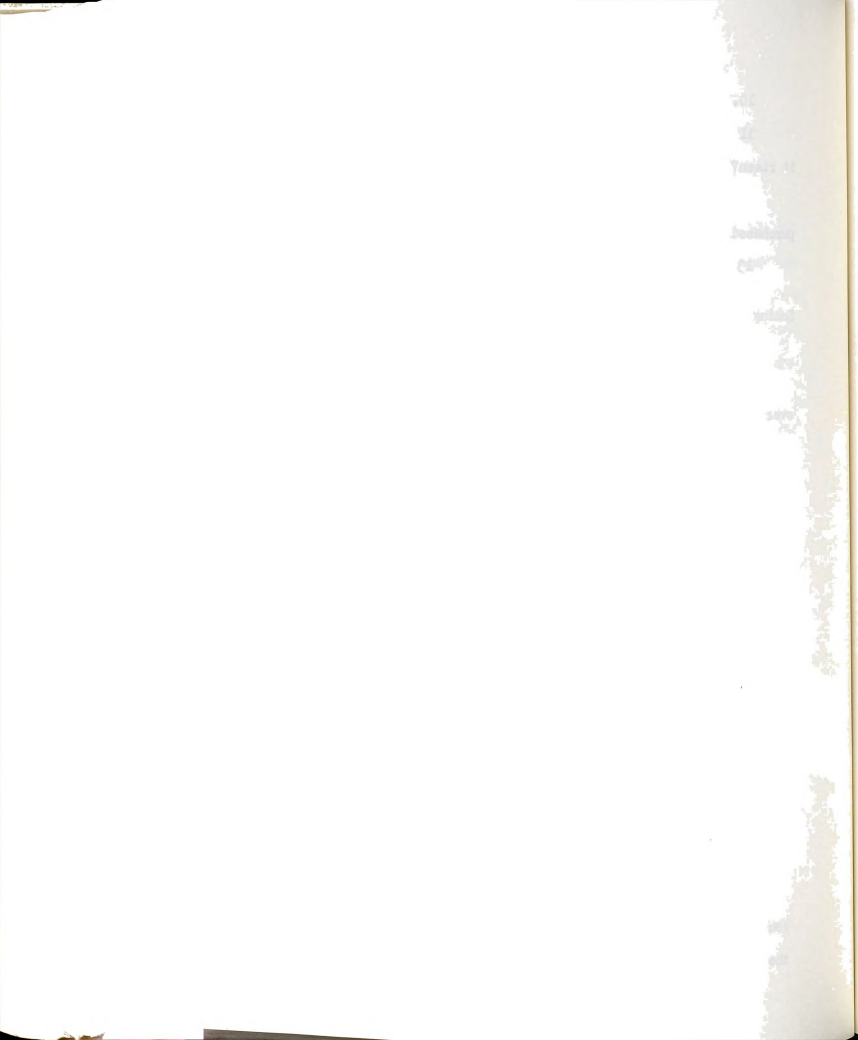
Sewer and Taxes:

20. Does Sewer availability affect your location decision? How?

21. Are there sewer supply problems?

22. Do sewer tap in fees and charges influence where you build?

23. Do jurisdictions (which) follow different policies on where you can (or how you can) hook on to sewers near other developments the end of the line?



24. Are there problems in getting sewer permits? Septic tanks?

25. How do you think the size and variation of the property tax payments in various jurisdictions affect where homes are built?

26. What is the price difference between sewerred and unsewered lots?

Concluding General Questions:

27. How have development costs changed?

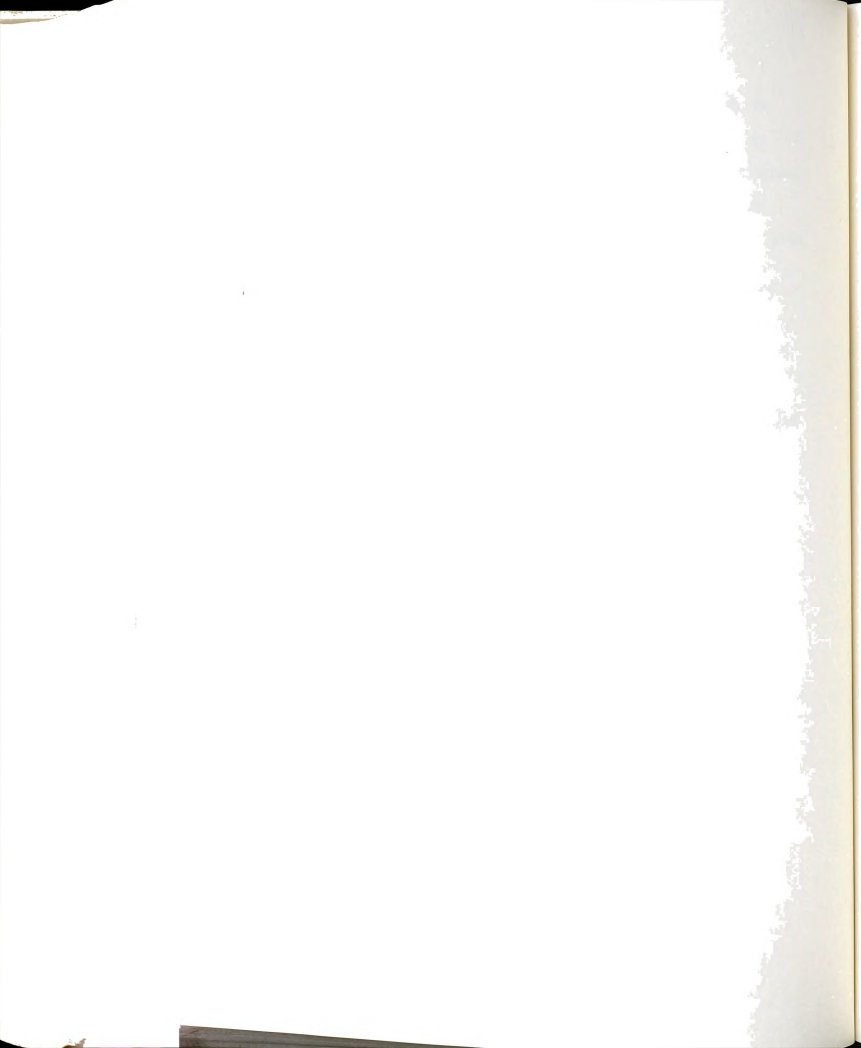
28. What do you see as the trend in land prices, past and future?

29. What are the main local government policies in which you see variation which affect the price of land?



APPENDIX E

EXAMPLE OF DEVELOPMENT COSTS IN LANSING, MICHIGAN



APPENDIX E

EXAMPLE OF DEVELOPMENT COSTS IN LANSING, MICHIGAN

Table E-1 presents data gathered by Walter E. Neller, a developer in the Lansing, Michigan area. This data was supplied to the Urban Land Institute to serve as an example of the impact of development costs upon the price of a housing site.

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TABLE E-1

CATEGORIZATION OF TYPICAL DEVELOPMENT
COST BREAKDOWN FOR SELECTED SUBDIVISIONS IN LANSING, MICHIGAN

	<u>\$ Per Salable Ft.¹</u>	<u>\$ Per Salable Ft.²</u>
Engineering and Planning	3.78	2.50
Water		
A. Distribution System (Including Taps)	9.02	7.75
B. Area Assessments Charges	1.11	---
C. Off Site Expense	---	.25
Sanitary		
A. Distribution System (Including Taps)	8.97	6.25
B. Area Assessment Charges	3.21	3.25
C. Off Site Expense	---	---
Storm		
A. Distribution System	4.36	4.50
B. Area Assessment Charges	4.61	1.50
C. Off Site Expense	---	1.50
Streets		
A. Interior System	17.20	15.00
B. D and A Lanes and Passing Lanes	1.57	1.00
Grading	4.40	2.50
Sidewalks		
A. On Site	2.74	3.50
B. Off Site	---	.25
Underground Electrical	---	1.00
Entrances	.32	.30
Lighting	1.09	1.75
Open Space		
A. Land	6.46	6.50
B. Improvements	---	---
Misc. Expense Items	1.01	1.00
Land (Direct Only)	20.00	20.00
Administrative & Promotion	6.00	6.00

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TABLE E-1 (continued)

Deeds, Abstracts and Etc.	1.25	1.25
Carrying Costs	7.50	7.50
TOTAL DEVELOPMENT COST	<u>104.60</u>	<u>95.45</u>
Profit	19.40	19.55
TOTAL SALE PRICE	<u>124.00</u>	<u>115.00</u>

Subdivision	No. of Lots	Salable Footage	Acres
"A" Sec. I	122	9,738	39.6
"B" Sec. I & II	222	17,729	67.94

Source: Walter Neller, Developer, Lansing, Michigan.

¹Prepared for Urban Land Institute Exc. Comm. 10/14/77.

²Prepared for Urban Land Institute Exc. Comm. 5/7/76.

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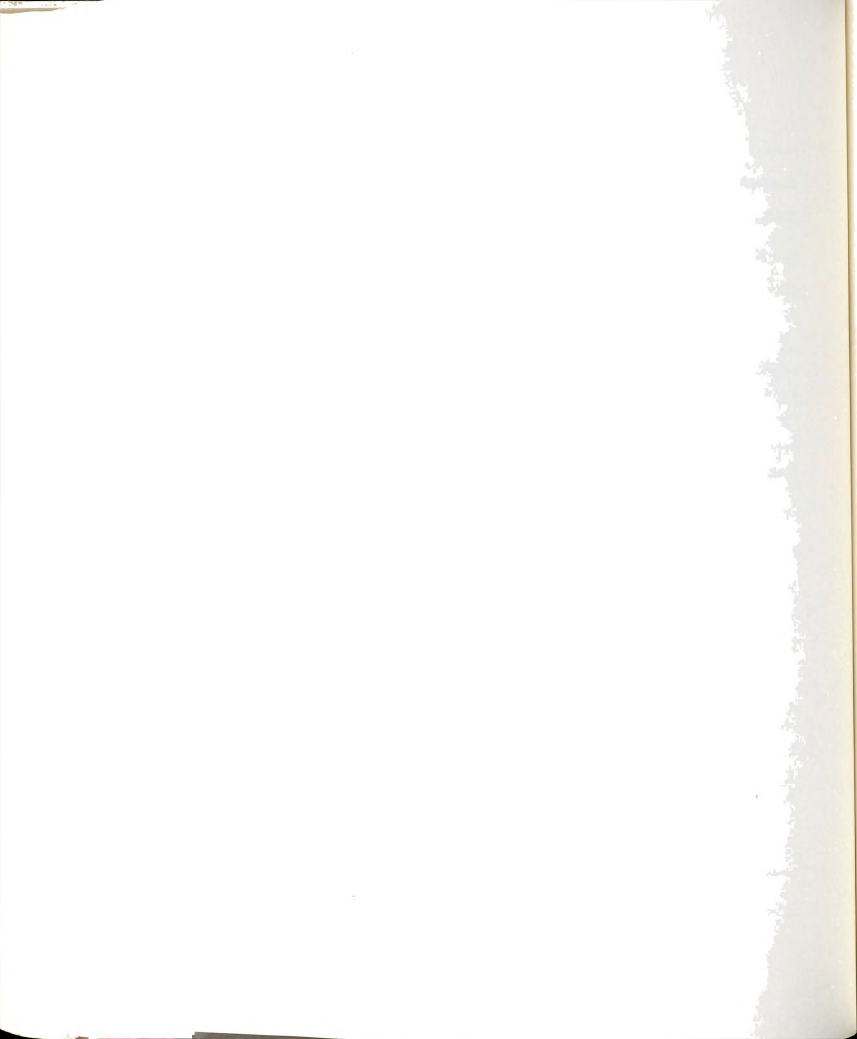
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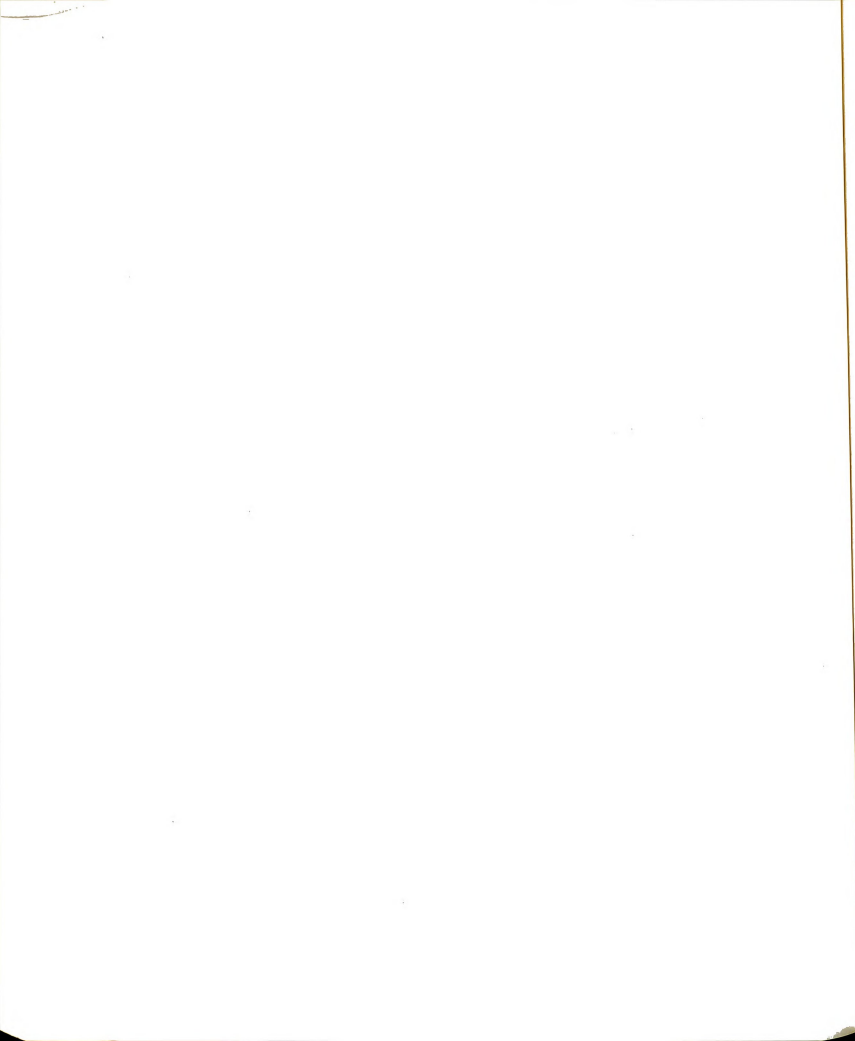
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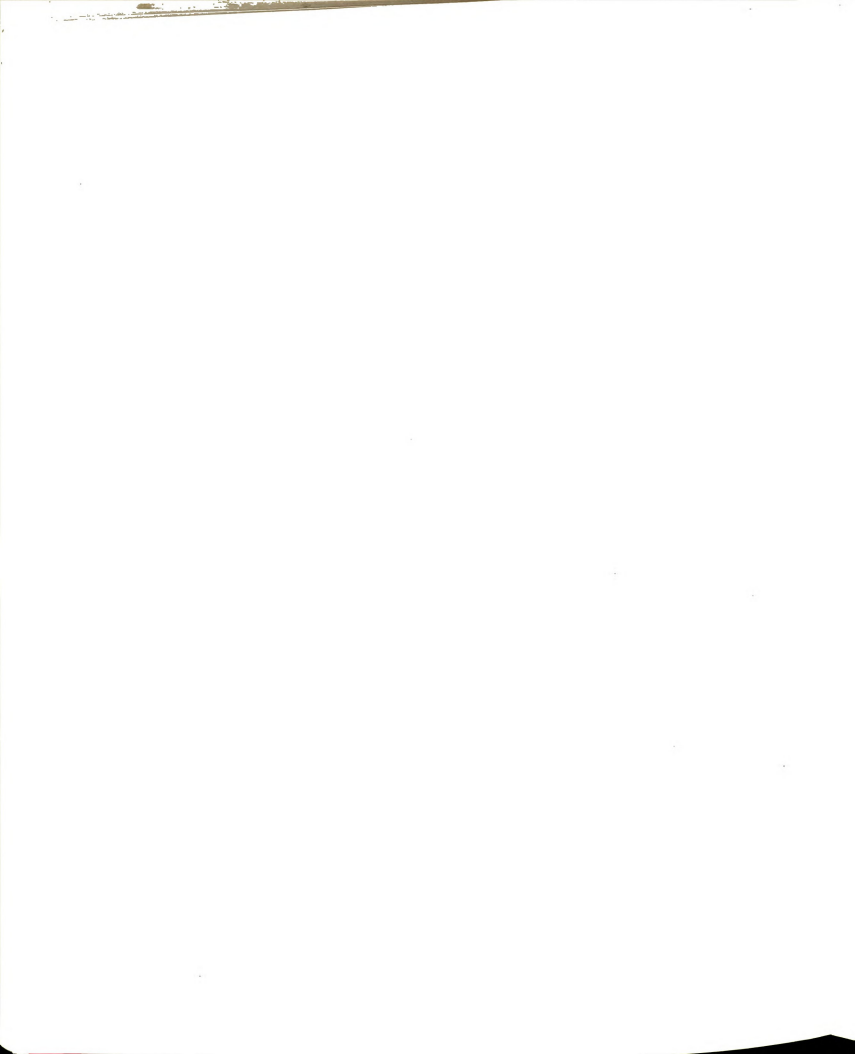
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