Availability of urban infrastructure and its effect on a subjective measure of housing adequacy in the formal and informal sectors in the city of Oaxaca, Mexico

by

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CHAPTER 1. INTRODUCTION

The Purpose

The purpose of this study is to examine the effect of the availability of urban infrastructure on the evaluation of housing adequacy by the resident. Data collected in 1987 and 1992 in the city of Oaxaca de Juárez, Mexico are used to accomplish the purpose of the study.

Statement of the Problem

Since the 1950s, governments of developing countries have tried to provide housing for their increasing urban populations by adopting mass-production schemes. Research demonstrates, however, that population increases in developing countries have been greater than the capacity of national governments to satisfy the demand. Research also shows that the provision of adequate housing requires more than the conventional public approach of mass production to satisfy not only the needs, but also the desires and expectations of low-income people (Willis and Tipple 1991; Roberts 1978).

Finding affordable housing in urban areas (that is, adequate housing, according to an individual's economic capacity, needs, and aspirations), has become a common problem for most people, except for the wealthy. LaNier, Oman, and Revee (1987), and Méndez-Rodríguez (1989) distinguish four factors affecting the provision of adequate housing in developing countries:

- Access to legal, and affordable land
- Access to basic urban infrastructure (water, sewer systems, solid waste collection)
- Access to financial mechanisms
- Access to affordable construction materials

Although access to land in urban areas of most developing countries has been relatively easy through invasion, basic urban infrastructure and access to financial mechanisms and to affordable construction materials still remain as major constraints to the acquisition of decent housing. Invasions have resulted in the creation of squatter settlements, some of which lack basic urban infrastructure, are unsanitary, and in many aspects are unsafe. This study concentrates on the analysis of the relationship between availability of basic urban infrastructure and the adequacy of the house.

Importance of the Study

The importance of the study lies in the relation between the availability of urban infrastructure and the resident's assessment of her house, and between this subjective perception of the house and the social and health status of the household. Housing has a sociopsychological meaning in giving status to the user and providing a safe environment in which to function (Blum and Kingston 1984). The housing structure itself meets the individual's needs for privacy, security, and adequate health conditions. If the house does not provide these characteristics, it is perceived as being of low quality. That, in

turn, can have negative effects on the individual or the entire household, socially or psychologically. Low-quality housing can affect the health of the family "as a result of its indirect social effects" (Morris and Winter 1978, 7).

In this study, the resident's response to the availability of public infrastructure in evaluating housing conditions is essential to discover the importance of the provision of public infrastructure in reducing housing deficits. The analysis of the availability of urban infrastructure and its importance in determining deficits is essential in other urban centers of developing countries where the provision of urban infrastructure is out of the control of the resident. The analysis, is also important considering that the quality of housing has a greater repercussion on the health of the individual than the quantity of housing (Ramírez-Vasquez 1980).

CHAPTER 2. THE CITY OF OAXACA

General Considerations

Geography

The city of Oaxaca (Figure 2.1), capital of the state of the same name, is located in the center of the Valles Centrales region, which is formed by the convergence of three mountain ranges in southern Mexico. Oaxaca City is about 507 kilometers (317 miles) south of Mexico City, and about 1,500 meters (4,500 feet) above sea level. One of the most salient characteristics of the state is its location within a mountainous region with few flattened areas and valles. This mountainous characteristic determines the variation in climatic conditions throughout the state, going from extreme cold in the mountains of the North, to rain forest in the East, and West, and dropping to the hot and humid climate of the Pacific coast in the South. In Valles Centrales, temperate climatic conditions predominate throughout the year providing Oaxaca City with one of its most attractive qualities. The average high in the city is 29.3°C (85°F) and the average low is 12.5°C (55°F) (Banamex 1979).

History

Internationally, Oaxaca is known primarily to those interested in Pre-Columbian art and architecture, Colonial architecture, and craftsmanship. Among the Pre-Columbian sites in the valley, Monte Albán stands out for its size, plazas and architectural style.

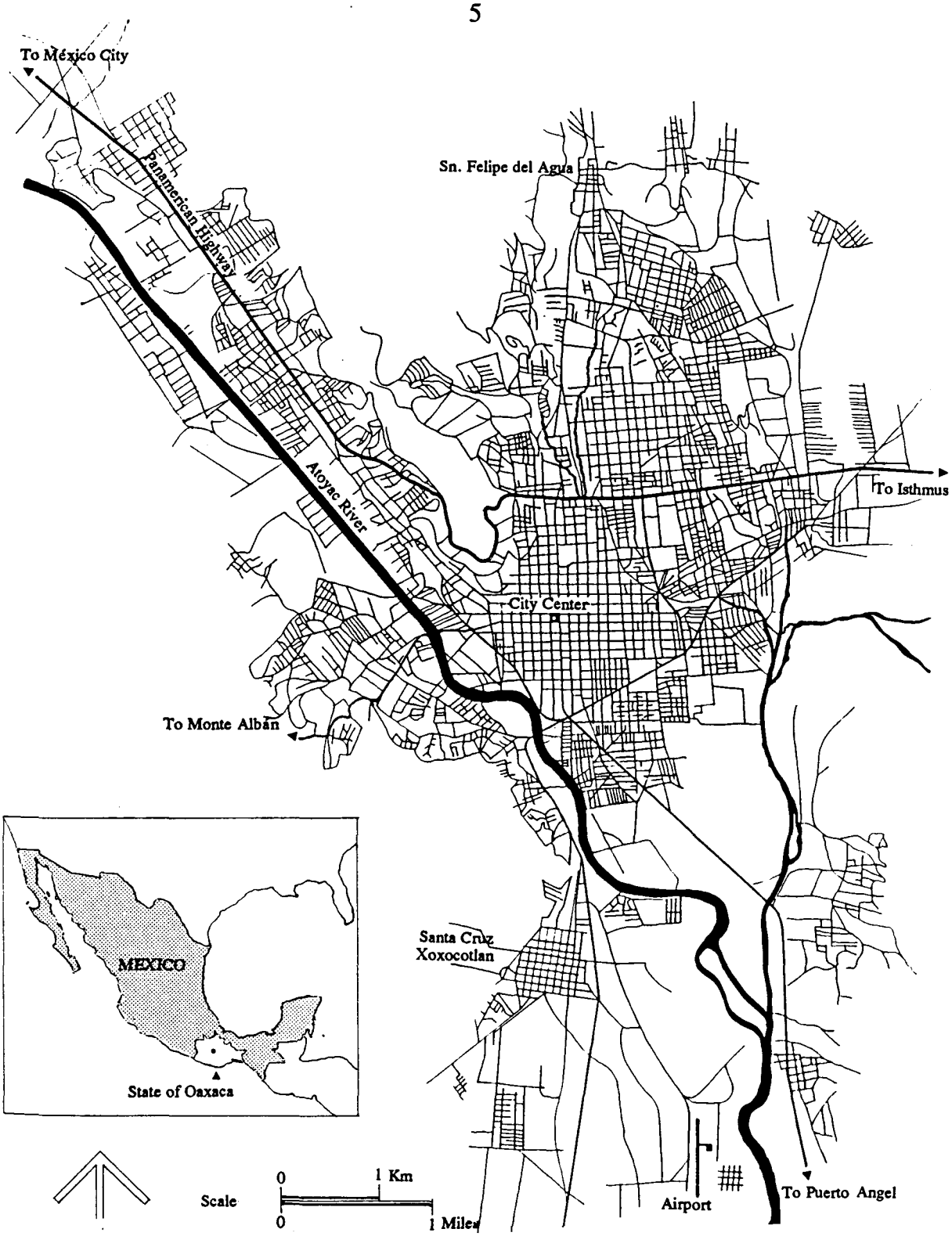

Figure 2.1 Mexico, the state of Oaxaca, and Oaxaca City

Monte Albán, located six miles west of Oaxaca City, is recognized by many scholars as one of the two earliest urban centers in the Americas. The city was founded around 400 B.C., presumably as the Zapotec capital. Monte Albán is a man-made acropolis built on top of a mountainous outcrop overlooking three important valleys of central Oaxaca. The urban center has a series of open spaces connected by buildings of different sizes and shapes. Among these buildings is Mount "J", one of the first buildings in Mesoamerica that can be consider a giant chronographic marker (Miller 1990).

Colonial architecture is also significant for its urban and aesthetic qualities, and Oaxaca City has become a national and international landmark in that respect. Oaxaca City, for example, like many other Latin American cities, was laid out on a grid and has a main square, or zocalo, that serves as a point for socialization and community identity. Socially, the zocalo dominates urban life and physically it becomes a focal point from which the rest of the city radiates in all directions (H. Ayuntamiento de Oaxaca 1991).

Craftsmanship is another characteristics that differentiates Oaxaca from other parts of the country. In recent times, craftsmanship has become a tourist attraction, and a source of income for many Oaxacans. Although not all handcrafted items are produced in the urban area, the city itself has become the trading center for most of these products. Among the items produced are weaving, black and green pottery, and wooden carved animals that have reached national and international markets (Banamex 1979).

Economy

In economic terms, Oaxaca City has been classified as the poorest capital in the nation. For much of its history, Oaxaca has remain isolated from the rest of the country, and it was not until the 1940s that the city was connected to the rest of the country with the construction of the Pan-American Highway. Since the inauguration of the highway, which has been an important factor in Oaxaca's economic growth, the city has become an important tourist, center while still maintaining its administrative role for the state (Stern 1973; Unikel 1976; INEGI 1992).

The city of Oaxaca's economic base is concentrated mainly in the services sector, local commerce, construction, and a very limited industry. Since the 1940s, the city has increased its dependency on the surrounding region. Employment in the industrial sector has declined, commerce has remained constant, and employment in the construction sector has increased, especially during the 1970s. Increases in construction have been related to the physical expansion of the city (Murphy and Stepick 1991).

Demography

Oaxaca City's present population is 342,338 inhabitants with migrants composing approximately 75 percent of the population (INEGI 1992; Rees, Murphy, Morris, and Winter 1990). Oaxaca's urban population has steadily increased at an average annual rate of four percent since the 1940s (Figure 2.2). This annual rate compares to the seven to ten percent growth experienced by three of the largest cities in Mexico-- Mexico City,

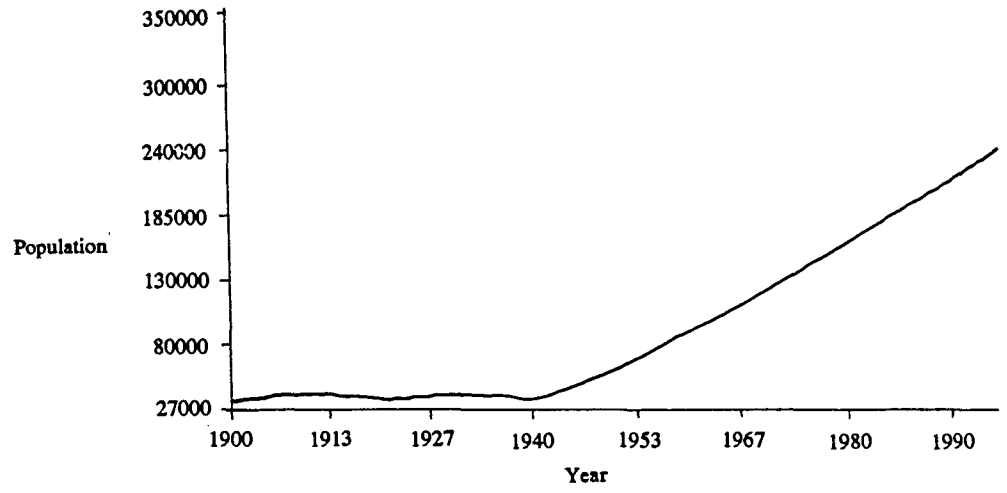

Figure 2.2. Oaxaca City's current population growth (Murphy and Stepick 1991, 47)

Guadalajara, and Monterrey--and to an average 5.6 percent at the national level (Murphy and Stepick 1991, 46; Selby, Murphy, Lorenzen, Cabrera, Castañeda, and Ruíz-Love 1990). Constant population growth, however, did not make an immediate impact on the city during the 1940s and 1950s, which was a period of economic growth and the expansion of the industrial sector. Several factors are considered to be the causes of these increases, but perhaps the most important has been migration.

Migration is one of the major elements accounting for the urban explosion in Latin America during the past three decades and Oaxaca is no exception. The relationship between migration and relative economic opportunities in urban and rural areas explains much of the population expansion of urban Oaxaca. For the most part, migrants in the city come from within the state, with a smaller portion from other states and the city of Mexico City (Rees et al. 1991).

Whiteford (1976) suggests that the needs and aspirations of migrants in urban Latin America differ depending on where they come from. In Oaxaca City, it is possible to find migrants who have prospered in the city, but for the most part, migrants depend on informal means to survive, and are poor.

Urban growth

The physical expansion of the city shows the dramatic effects of the continuous population increases of the last four decades. In the Colonial period, the city was very well defined by the order established on the grid. As time went on, the city grew uncontrolled, covering much of the hills on the north and west, and small portions of the flattened area in the south.

During the 1940s and 1950s, the growth of the urban space went unnoticed because the majority of migrant families, as in many other cities of Mexico, were renters who lived in the central area occupying old houses or were living in the outlying neighborhoods of the city. During the 1960s, however, constant uprisings and the lack of response from the government led to the invasion of privately owned and public land by the poor. These invasions marked the beginning of the struggle for housing among the poor, but also the beginning of an uncontrolled and almost chaotic physical growth of the city that still continues (Butterworth 1973; Selby et al. 1990). Murphy and Stepick (1991) report that in mid-1970s about 60 percent of the urban space was occupied by some housing that began as invasion (Figure 2.3).

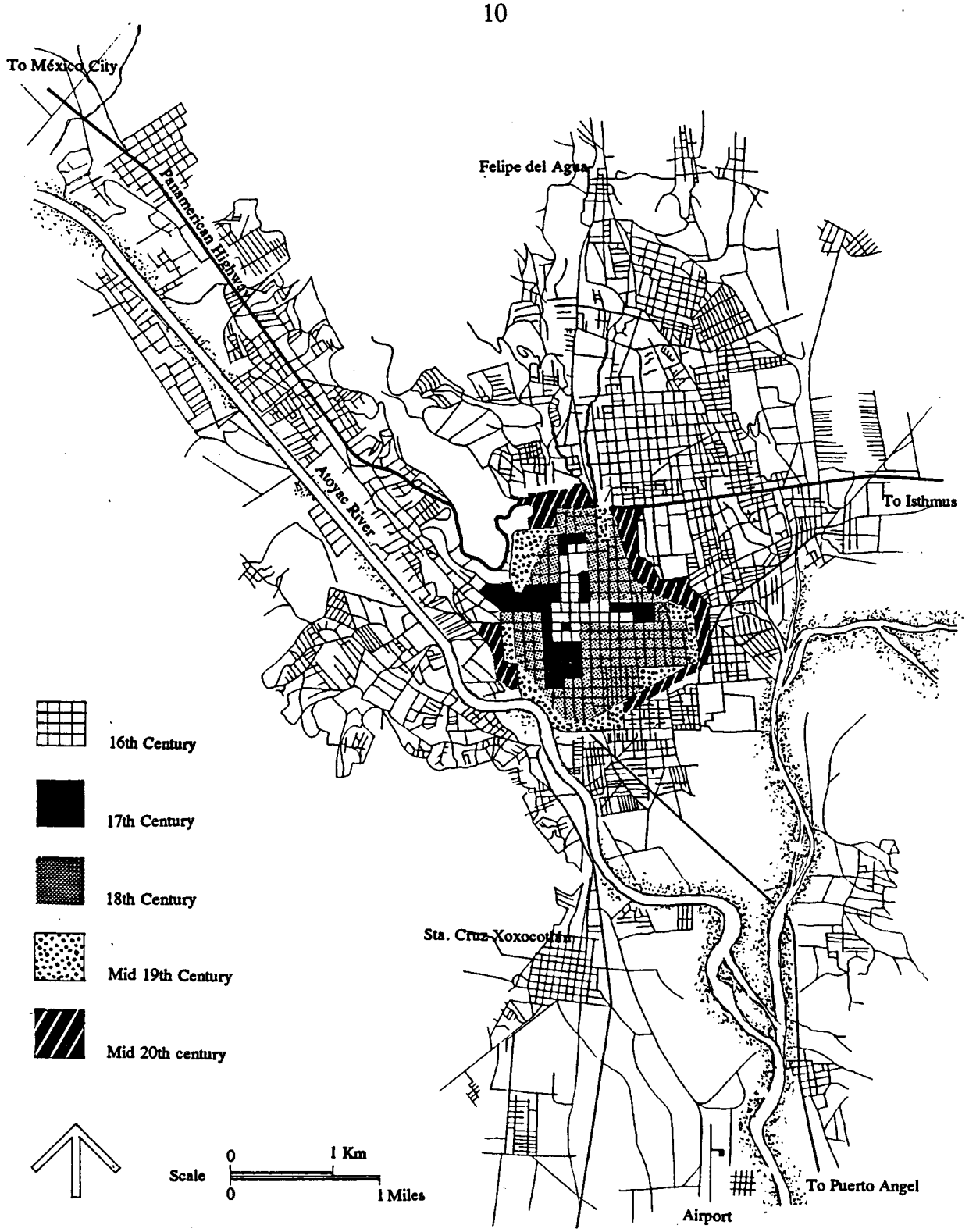

Figure 2.3. Oaxaca City's urban growth (Murphy and Stepick 1991, 64)

Housing Conditions

Housing conditions in Oaxaca resemble those in other parts of Latin America. There are high-quality dwellings and low-quality dwellings, with a preponderance of the latter. There are houses having access to all urban services and houses having no services at all (Figure 2.4). Although most residents always look for the best, not all can obtain the dwelling they wish.

According to the 1990 Census, there are 68,247 houses in the city. Eighty percent of the dwellings have piped water and 65.7 percent are connected to public-sewer lines. The occupancy rate is 4.9 persons per dwelling compared to 5.1 persons per dwelling for the state (INEGI 1992).

In the city of Oaxaca, there are different types of neighborhoods that define different types of housing, including government housing, "Pueblos conurbados" (independent towns that have been subsumed by the city), the center of the city, "colonias populares" (originally squatter settlements) classified as poor, near poor, and not poor, and middle-class neighborhoods (Pacheco-Vasquez, Morris, Winter, and Murphy 1991).

In a study based on data collected in 1987, Pacheco-Vasquez et al. (1991) found that 67.6 percent of the people interviewed were living in colonias populares, 11.1 percent were living in the center, 8.6 percent were residing in pueblos conurbados, 7.0 percent were living in government-housing projects and only 5.6 percent were living in middle class neighborhoods. Of those living in colonias populares, almost 80 percent were migrants to the city.

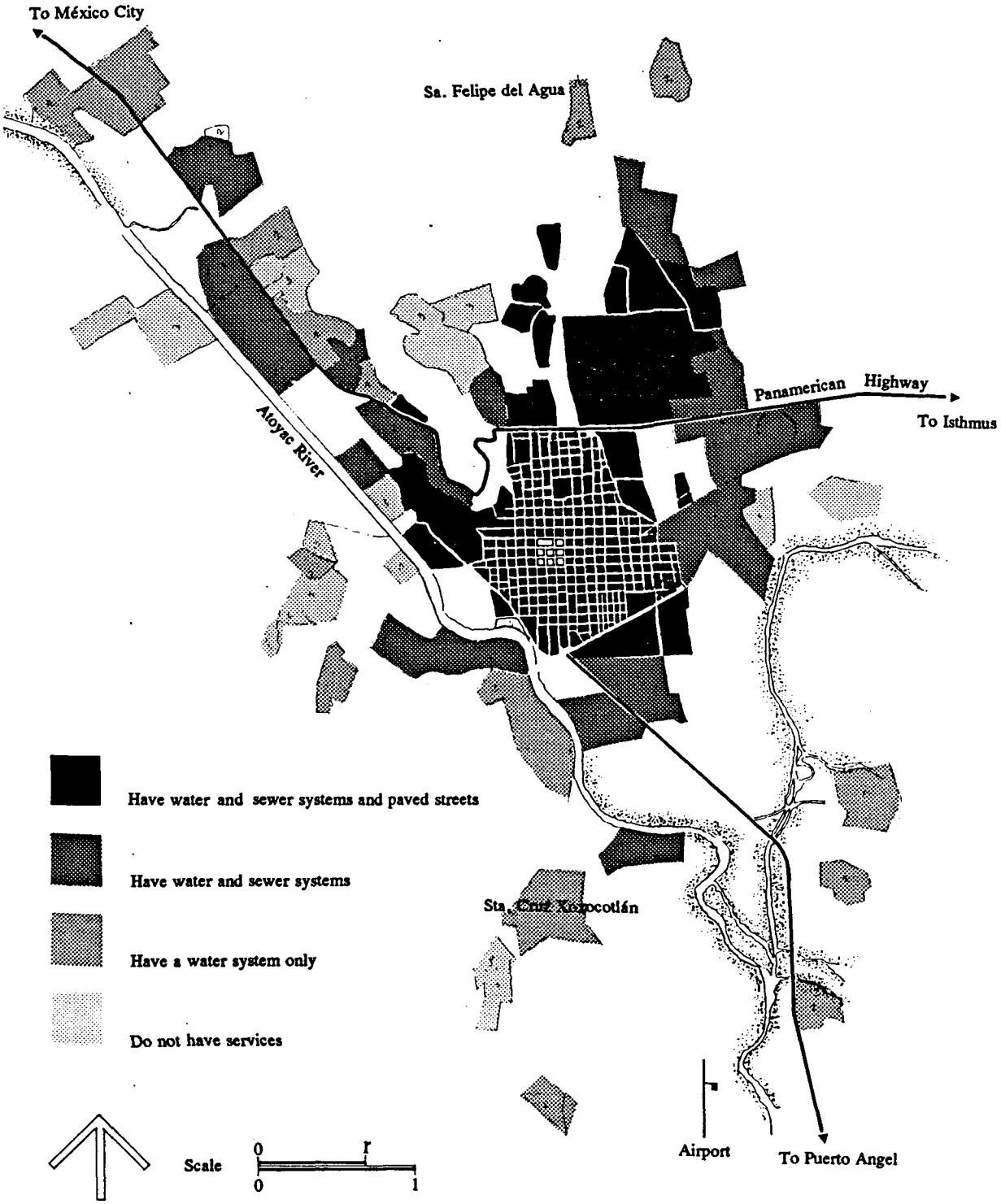

Figure 2.4. Oaxaca City and its colonias according to availability of urban infrastructure

The level of living and housing quality of households residing in colonias populares is among the lowest reported for all neighborhoods at the time of the interview. Ownership of the dwelling is common in all neighborhoods, except for the center of the city, where 61 percent of the people are renters (Pacheco-Vasquez et al. 1991).

Families living in government-housing projects are the youngest, with the smallest families and the lowest numbers of workers per household. This group, however, has one of the highest household incomes, indicating the importance of a formal sector job to maintain a household with only one income earner. Their subsidized housing provides them with the highest aggregate level of living in the city; however, they represent a very small portion of the population. These findings suggest that Oaxaca is one of the cities in Latin America where the most obvious results of urbanization and housing shortage can be found. As Ramírez-Vasquez (1980) suggests ". . . urbanization problems are in most cases dramatically reflected in colonias populares for they show the dwellers well-being and thus the state of the economy" (p. 3).

In colonias populares, it is common to find makeshift houses made with cardboard or reeds for walls and roofs. In these neighborhoods, housing is, in most, cases constructed by the residents themselves, and lacks basic infrastructure. Although many of colonias populares start as invasions, the majority of them have been legalized or are in the process of regularization (Selby et al. 1990).

In the city of Oaxaca, land speculation has been one of the key elements in the provision of housing for low-income groups. Land speculation in the center and near the

center of the city has led to low-cost land outside the urban area. In spite of their constitutional protection from speculation, communal lands have been the target for new settlements beyond the city boundaries. Cheap land, however, is, in most cases, related to the lack of infrastructure and the distance from the city center. The further away from the city center, the cheaper the land, but also, the fewer the services provided.

The city of Oaxaca urban context is changing and it is not difficult to see those changes when walking around the city. People are busy and do not seem interested in talking to strangers. Residents in all neighborhoods are working hard trying to improve the look of their houses and their neighborhoods. It resembles an urban-renewal project being carried out through the city, where people are actively involved. Oaxacans, with the help of the government, are installing new water and sewer systems. They are also paving streets and planting colorful trees. Some said that the 1910 revolution is finally bringing justice to their homes. Others, like Don Antonio, a 34-year-old squatter, believe that justice will never come. He sees his house and that of his neighbors being torn down and burned by others who claim to be the owners of the land near Sn. Andres.

Uphill, on top of "Colonia Sabino Crespo" live Doña Lancha and her family. She has a business by the bus stop where she spends most of the morning selling traditional snack food. She and her husband arrived to the city 30 years ago and settled on top of the mountain. "I feel fortunate," she says, "because we can see a good portion of the city from here, and see how the city changes her makeup every day." At Doña Lancha's house, water does not come from the municipal system, but they have survived by

carrying it from far away and recently by buying water from "pipas" (water trucks). Her family has no toilet, but they are not interested in having one because the large open field behind their house accomodates their needs. "These people," Doña Lancha said as she was looking towards a new and illegal neighborhood downhill, "are less fortunate because they are all packed together and they do not have sewer lines nor do they have land as much as we do." Oaxaca City looks different from five years ago. Construction is taking place in all directions, transportation appears to be of better quality, new roads are being constructed, and people, in general, seem more confortable. However, the poor are still considered the last group to worry about when decisions are made regarding public housing. They are being housed in new squatter settlements on the hills where more shacks are built with the typical low-quality features. Nevertheless, Oaxacans are confident that good times are yet to come.

CHAPTER 3. REVIEW OF LITERATURE

In assessing the adequacy of housing in urban centers, researchers have used several approaches that differ in their procedures. Most of the approaches, however, can be classified in two groups: 1) those that view housing as being part of the built environment and, therefore, consider other aspects of urban life in their measures, and 2) those that view housing as part of the built environment, but concentrate on the study of the physical characteristics of the dwelling that helps determine its quality.

Considering housing as part of the built environment is a more comprehensive approach, but it lacks input from the residents and it does not provide an accurate measure of adequacy. Considering housing by itself is an approach that uses the resident as its main source of information to develop indexes for measuring housing quality, but this approach lacks the integration of other important factors defining the built environment. Integration of both approaches could be beneficial in defining housing quality indexes that are sensitive to the conditions of urban areas in developing countries where urban infrastructure is minimal. In this study, housing quality is conceptualized as being determined by two types of factors: 1) external factors, and 2) internal factors or characteristics of the dwelling.

The literature review is divided into three parts. First, literature is reviewed on housing quality and factors related to housing quality. The second section reviews literature on urban infrastructure and related factors. In the last section, literature is

reviewed on housing adequacy and the importance of housing conditions and the provision of urban infrastructure when determining levels of housing adequacy.

Housing Quality

Definition

Housing quality has been defined in different ways by different disciplines. This section examines housing quality from three different perspectives:

- As a set of minimum [underline mine] standards for habitation that go beyond the dwelling itself; cost, the structural qualities of the dwelling, crowding, choice [allowing people to decide which services fit them best], neighborhood, access to community services, and control over housing tenure (Connerly and Marans 1988, 38-40; Lieder 1979, 632-633)

- As a combination of characteristics derived from the implicit attributes of the housing unit which satisfy the normative needs of the individual or the family (Morris and Winter 1978, 126-133)

- As a symbolic value attached to the dwelling for what it does rather than for what it is made of (Turner and Fitcher 1972, 148).

The first definition is well accepted among planners, who have tried to create more humane residential environments than those where urban workers and migrants have traditionally lived since the first decades of the industrial revolution (Scott 1971). Poor living conditions prevailing in urban centers was one of the major factors that led to the adoption of zoning, subdivision controls, building and housing codes, sanitation ordinances, and other health and safety regulations that are now accepted as ordinary responsibilities of local governments in most countries (Lieder 1979; Ranson 1991).

Because of the social movement for quality housing, a constant preoccupation of planners and designers has been to create housing developments that include acceptable levels of adequacy based on minimum standards for habitation: design, space, construction materials, and services within the dwelling. This approach has resulted in the adoption of mass-production schemes of housing that have made dwellings available to those who can afford them. Owned and rented housing has been built either by the public or the private sector, based on minimum standards that designers and planners have thought as adequate, paying little or no attention to the standards set by users (Marcus and Sarkissian 1986).

Charette (1986) demonstrates that there are differences between users and designers in their perception of what makes a place a good place for living. She examined different physical, social, management, and services characteristics of housing at the unit level and the neighborhood level. She found that the overall perception of residents of what makes a place a good place for living is associated with all four factors, with the social factors having less importance. For the designer, only social factors were associated with the perception of a good place for living. In addition, she found that, among the physical factors that make a place a good place for living, the designer considers the look of the house to be the most important factor. Others (Kinsey and Lane 1983; Inman 1988) have found that space limitations within the dwelling are causes of housing dissatisfaction and can lead to stress.

Mass-production schemes have been used in most countries in dealing with

housing shortages (Mangin 1967). The adoption of such schemes in developing countries, however, has not solved the problem of housing for low-income people because housing produced under the standards of mass-production schemes is generally out of the reach of the average person (Palacios-Echeverria 1990a).

Housing produced under minimum standards in Mexico, for example, has generally been provided only to salaried workers as mandated by the Mexican Constitution. Nevertheless, this type of housing is regarded as being of poor quality by occupants. Individuals living in government-sponsored housing often complain about interior and exterior space limitations, particularly, interior limitations and their relationship to crowding problems. Hoenderdos and Verbeek (1989) argue that space requirements and minimum standards for other aspects of the dwelling have been reduced to increase the profitability of construction enterprises and justify the affordability aspect of public housing.

Marcus and Sarkissian (1986) note that, although designers have developed skills in designing efficient indoor spaces, they have overlooked the external qualities of the dwelling associated with the built environment. They argue that, although most designers are aware of the social issues of housing, only a very small proportion have ever used social data for design purposes. Marcus and Sarkissian further argue that unsuccessftul housing is the result of the lack of understanding of the social implications of housing. To produce meaningful residential environments, planners and designers have to reconsider the residents' input.

The second definition of housing quality implies a concentration on the specific characteristics of the dwelling that families value as important in meeting their housing needs. According to Morris and Winter (1978), families determine the characteristics of good housing by using cultural norms. Cultural norms are the ". . . rules [that society promulgates] or standards [established to the functioning of the family], both formal and informal, for the conduct and life conditions of members of a particular society" (p. 16).

Morris, Woods and Jacobson (1972) used a measure of housing quality that combines the structural quality of the dwelling, services availability within the dwelling, and the state of maintenance and caretaking. Following the same criteria, Harris (1976) measured exterior and interior quality of the dwelling. The resultant index of housing quality was found to be reliable and adaptable for use in measuring quality under a range of housing conditions and standards in the United States.

Lane and Kinsey (1980) use an index of housing quality that is a combination of problems with plumbing, security, structure of the dwelling, pests, and insulation or heating systems. These researchers, and others (Schnittgrund 1982; Johnson and Abernathy 1983; Danes and Morris 1986) have found that most aspects of housing quality indexes are significantly associated with housing satisfaction.

O'Bryant and Wolf (1983), and Grant (1985) found that, housing quality is positively related to housing satisfaction. The higher the quality of housing, the higher the satisfaction with the dwelling. It is also possible to be dissatisfied with specific features of the dwelling, but generally satisfied with the whole (Brink and Jonston 1979).

The third definition of housing quality is important for it delineates housing quality within the context of developing countries. It is also important because it recognizes the resident's values as the main determinant of housing adequacy. According to this approach, housing is a constant process rather than a final product. The quality of a house has to do with its symbolic dimensions and not with the objective qualities of its components. Consequently, the house should not be viewed according to its physical characteristics ("what it is"), but according to its meaning ("what it does") to those who use it (Turner and Fitcher 1972, 148).

The idea that housing quality depends on the values of the occupant provided the basis for the development of the sites and services approach for housing provision among poor people in developing countries. Under the site and services approach, individuals are provided with a piece of land and a minimum of public services. Construction of the dwelling comes latter as the household's economic resources permit, usually through self-help methods (Van der Linden 1986).

The premise of the site and services approach is that individual autonomy provides freedom to built the best way people can, according to their economic capacity, and according to their needs and values. The concept is important for it has received support from international organizations such as the World Bank, and the U.S. Agency for International Development, among others, and because it became the mode of housing production for poor people in many developing countries during the 1970s and the 1980s (Williams 1984; Marcussen 1990; Palacios-Echeverria 1988).

Recent evaluations of the site and services approach (Van der Linden 1986; Marcuse 1992) show that the concept has limitations and is deficient in many respects. Two of the main reasons that the site and services approach failed are excessive government control and low community participation (Ward 1984). In referring to the government and resident participation, Prince and Murphy (1989) suggest that the regulative position of the government in the implementation of sites and services has overshadowed the whole idea of autonomy. They contend that:

> Planners must realize that they are not the "only people who can, or have the right to, plan." To understand the situation, planners must assume the residents" point of view is "rational," and attempt to understand the voiced needs of the community" (p. 17).

The site and services approach does not offer an objective measure of housing quality. The relevance of the approach, however, lies in its recognition of the resident's potential for development and the recognition for cooperative efforts necessary to obtain adequate housing among the poor.

Importance of housing quality

Housing quality has always been regarded as a factor of strength to the physical and mental health and the security of humankind. In urban areas, the concentration of large numbers of people have led to the constant evaluation of housing and its surroundings as they relate to the social stability of the individual (Young 1985).

Factors related to housing quality

Research shows that there are several factors affecting housing quality. Physical conditions of the dwelling better explain the quality of the dwelling than do the socioeconomic and demographic characteristics of the household (Kinsey and Lane 1983), but, in addition to the characteristics of the dwelling, there are socioeconomic and demographic factors (Grant 1985), location factors (Connerly and Marans 1988), and external neighborhood characteristics (Charette 1986) that are related to housing quality.

Quality and socioeconomic status Quality is positively related to socioeconomic status (SES) of the household. Goodman (1978) and Strickland (1990) used income and education respectively as a measure of SES and found that both are positively related to housing quality. Households with higher incomes and higher levels of education have better housing quality than do households with low incomes and low levels of education.

Morris, Winter, and Murphy (1988) used a more comprehensive measure of SES. They added the standardized versions of income, the number of working people in the household, the education of the head of the household, and a level of living score. They also found that SES is positively related to housing quality. "People with higher SES have higher quality mainly because they can afford it" (p. 5).

Quality and age of the woman Some researchers find age to be related to housing quality; others have found the opposite. The discrepancy might be explained by the setting where research is conducted. Morris, Winter, and Murphy (1988), for

example, found that age is positively related to housing quality among people in Oaxaca. The positive relationship, however, is positive only to a certain point and then decreases: as people age, quality increases and then declines at the higher ages. They suggest that the result may be related to the pattern of housing improvement, common among Oaxacans, and to the improvement in level of living generally achieved by the younger but not the old households. In the United States, however, Grant (1985) reports that age is not related to quality. Harris (1976) obtained the same results.

Research also indicates that elderly live in housing that is older, cheaper, and of lesser quality than younger households (U.S.D.H.U.D. 1978). Prentice (1977) concluded that age of the head of the household is significantly related to specific characteristics of the dwelling which, in turn, produce high housing and neighborhood satisfaction.

Quality and household size Household size is negatively related to quality. Morris, Winter, and Murphy (1988) indicated that the result is not surprising because larger households generally have to trade quality for quantity in housing. Goodman (1978) reported that household size has a positive effect on housing quality. In the Harris (1976) study, household size was found to be negatively related to housing quality.

Quality and distance Distance is an important factor in the analysis of urban life and its relationship to housing in terms of the convenience of services and places used by residents in day-to-day activities. Convenience has been used as an index of neighborhood quality. It has been measured in terms of the actual distance between a neighborhood and various activities centers such as work, school, shopping, and

recreation (Marans and Fly 1981). In other surveys, convenience has been measured in the time estimates respondents give for the travel to various activity centers (Michaelsen, Murray, Dikerman, VanAuken, and Early 1976).

Lane and Kinsey (1980) found distance from the dwelling to the center of the nearest city to be a significant predictor of both convenience and urban living. They found that distance has significant effects on renters. Distance is also important for local governments that show concern for urban growth and the necessary expansion of public services including water, sewer, solid waste collection, transportation, and community services like health care centers, and schools (Riedel 1979; INDECO 1982).

Quality and tenure The literature suggests that there are differences between owners and renters in terms of the housing conditions enjoyed by each group (Lane and Kinsey 1980). They demonstrate that rental housing has less desirable characteristics than does owned housing. Consequently, renters are less satisfied with housing quality than are owners.

Morris and Cho (1986) showed that there is variation in preferences of tenure and housing type between owners and renters. They found that, among owners and residents of single-family dwellings, there is no variation in preferences for tenure and housing type. They noted that among renters, household type, education, and household size are factors affecting housing preferences for tenure and structure type of the dwelling.

In developing countries, ownership plays a major role in the family's adjustment process when housing deficits are perceived. Among people in the informal sector,

ownership is an important component of housing quality because it is only when the family owns its house that major decisions are made to achieve gradually the desired kind of housing by modifying its present conditions (Gilbert and Varley 1989; Bazant 1988).

Others have also found distinctions between owners and renters. Whiteford and Morris (1986) found that, among owners and renters, only younger renters are not satisfied with their housing. Blum and Kingston (1984) note that owners are more likely to show traditional social values, participate in community-based activities, and join voluntary organizations than are renters. This social attachment experienced by owners is also reflected in other parts of the world. In Mexico, for example, ownership is regarded as one the most important aspects in the life cycle of the family. Home ownership among people living in squatter settlements motivates residents to get involved in community activities to improve the quality of their residential areas (Cadena-Perez-Campos and Romero 1986; Gilbert and Varley 1989).

Morris, Winter, and Murphy (1988) found that, in Oaxaca, economic constraints do not interfere in the family's decision to acquire their own house. While ownership is within the reach of even the poorest families, renting is not. Once a house is owned, families are more likely to make alterations than renters. Quantity and quality, they contend, are added to the housing as resources permit.

Quality and sector of participation Literature on the informal sector and housing quality shows that more and more individuals in developing countries are forced to rely on self-help practices to obtain housing. Literature also suggests that the quality

of housing has become more important than the quantity aspect of it (Bazant 1988).

Since the late 1960s and early 1970s, labor market specialists have used the formal-informal sector dichotomy to interpret some of the manifestations of emerging economies in the developing world. Formal and informal economies are part of the traditional private sector. The private sector covers formal enterprises and organizations owned by particular individuals, and informal activities that include low-scale enterprises that are not formally registered, do not maintain an strict accounting and employ workers temporarily (Palacios-Echeverria 1989; LaNier, Oman, and Reeve 1987).

The term "informal" is used to classify urban activities that employ the large number of people who can not be absorbed by "modern" enterprises and whose employment status does not guarantee them a regular income. These informal activities differentiate from the formal activities in that:

> They are, for the most part, ignored by government; they are not enumerated in employment statistics nor is the income generated by such activities included in any measure of economic activity (the Gross National Product, for example) (Winter, Morris and Murphy 1987, 2).

In Mexico, one of the clear distinctions between the formal and informal sectors is the provision of job-related services and benefits. Although the 1917 Mexican constitution, in its section 123 (INDECO 1982), establishes the basis for social security for all citizens, the welfare system focuses on the formally employed individual, leaving those outside the formal urban sector receiving very few services and benefits.

The welfare system in Mexico is centralized, with most of the programs administered by the government. In the welfare system, social security is obligatory in the form of workers' compensation programs that provide workers with protection against disability, unemployment, sickness, and accidents, and that require large industries to make provision for housing, schools and public services (Aguilar 1990).

The informal sector and housing provision Research on the informal sector and its role in the production of urban housing in the developing world shows that the informal sector, with no external assistance, produces more housing units than the public and the private formal sectors combined (Mendez-Rodríguez 1989). Research also shows that, despite of the time and energy devoted to building a house, the informal sector is able to satisfy the need for shelter in short periods of time and according to the resident's housing values (Van der Linden 1986; Palacios-Echeverría 1988). In Mexico, it is estimated that approximately 70 percent of the existing housing of most urban centers has been produced by the informal sector using rudimentary methods and materials with no financial assistance (Bazant 1988; Mendez-Rodriguez 1989). Housing provided by the informal sector, however, is often classified as inadequate and unsanitary because of the low quality of its structure and the absence of basic urban infrastructure. The fact is that even the poorest of the dwellings means a great deal for its occupant who otherwise would be homeless. Palacios-Echeverria (1989) argues that the problem begins in the inability of society to employ all of its population. Thus, he says, all of those not being integrated into formal productive activities have to provide housing for themselves

the best way they can, usually through illegal methods and with limited resources.

In Mexico, housing for formal sector workers has been provided by the Instituto Nacional del Fondo de Vivienda para los Trabajadores (INFONAVIT). INFONAVIT is financed by a ". . . 5% levy on the wage bill, paid by employers" (Ward 1984). The acquisition of housing in an INFONAVIT development is determined by lottery (Murphy and Stepick 1991). To be part of the drawing, however, an individual has to be in a waiting list for a certain period of time. Señora Renteria, a janitor in a private company in Oaxaca, for example, commented that she had been waiting for almost four years to get in one of those drawings. She said she could not understand why other people that have worked in the same place for almost the same period of time as she had, were getting houses and she was not even considered for a drawing. ". . . fortunately" she said, ". . . we don't pay much for rent, and I'll keep waiting until I have a chance to get in a drawing, or until I get a better job and I can buy my own lot."

Urban Infrastructure

In Chapter 1, access to land, access to urban infrastructure, access to financial mechanisms, and access to affordable construction materials were identified as determinants to the acquisition of adequate housing in developing countries. In this study, however, only access to urban infrastructure is subject to exploration.

Because of its complexity and cost, the provision of urban infrastructure has been the responsibility of urban governments since at least Roman times (Tabors 1979). In

developing countries, however, a constant population explosion has exhausted all the available services in urban centers and the ability of governments to respond efficiently.

Improvement of public services, in developing countries, is a function of socioeconomic status (Gilbert and Ward 1985). Wealthy residential areas have services installed before homes are occupied, while low income residential areas sometimes have to wait many years before obtaining services. Gilbert and Ward (1985) distinguish three kinds of urban services improvements:

> . . . [1]when infrastructural provision is crucial to powerful economic and upper-income residential groups but is sufficiently complex or expensive that its provision requires at least partial public sector input; [2] when services are of interest to all social groups but are provided by the private sector for those who can pay; and [3] when services are provided solely by the public sector, primarily for the poor (p. 172).

Castells (1979) suggests that state intervention in the provision of urban infrastructure has increased over the years in part because this provision is generally an area of low profit to the private sector and in part because of the increasing popular demand for those services. Social pressure has forced the government to improve the provision of water services (Bennett 1989; Zolezzi and Calderon 1985).

In developed countries, unsanitary slums are subject to evaluation for their potential clearance. In developing countries, however, despite low levels of living and unsanitary conditions prevailing in squatter settlements, they are legalized as a way of providing housing to poor people who otherwise would be homeless (Payne 1984). This problem has been recorded in Mexico by Gilbert and Ward (1985), who wrote:

> For many years, the PRI [the party in power] has controlled large sections of the low-income population through its manipulation of land and service provision. Services have been channelled to favored client groups. Under recessions, of course, such methods of social control are harder to operate (p. 3).

In squatter settlements, residents often lack a water supply suitable for drinking. Squatters often lack adequate resources for the removal or disposal of excreta and other wastes; they are often more exposed than others to dust, chemical pollution, and noise, and the nature of their dwelling make them less able to defend themselves against these hazards (WHO 1987). Often, the inability of poor people to pay for urban infrastructure is linked to their participation in the informal sector of the economy, where the wellbeing of the family depends on informal sector labor market and its constant fluctuation.

Importance of infrastructure

The importance of basic urban infrastructure is related to sanitation of the living environment. Sanitation as a healthy housing requirement has long been recognized by the World Health Organization (WHO 1961). Environmental "factors in man's [or woman's] physical environment. . . exercise or may exercise a deleterious effect on his [or her] physical environment, health and survival" (Ranson 1991, 95).

The incidence of diseases, particularly enteric diseases such as infantile diarrhea and parasitic infections and respiratory diseases such as tuberculosis, pneumonia and other chest infections, have long been associated with slums and squatter settlements. It has been demonstrated, for example, that poor quality housing, poverty, malnutrition, and

ignorance in squatter settlements are responsible for increased infant mortality rates (Kirke and Arthur 1984).

Among the environmental factors identified as potential sources of disease are contaminated water supply, poor disposal of solid and liquid wastes, and the proliferation of dust and other chemicals into the air. Adequate housing depends on the provision of adequate services, and adequate services are related to the health status of individuals. Water usage is positively correlated with the improved levels of health, "even if the quality of the water is poor." (WHO 1987,7). For the purpose of this study, the availability of basic urban infrastructure is explored as a determinant of housing adequacy rather than as determinants of health status.

Housing adequacy

Definition

Adequate or "healthy" housing is defined by the World Health Organization as:

> A human habitation that is structurally sound and relatively free from accidental injury hazards, provides sufficient space for all normal household activities for all members of the family, has a sanitary means of collection, storage and disposal of all liquid and solid wastes, it is provided with appropriate installed facilities for personal and household hygiene and cleanliness, is sufficiently weatherproof and watertight, provides proper protection from elements,. . . has natural and artificial means of illumination that are safe and adequate in quality and quantity for the fulfillment of all normal household activities and functions,. . . provides adequate protection from insects and rodents which may be reservoirs and/or vectors of disease agents, and is served by the necessary and/or desirable health, welfare, social, educational, cultural and protective community services and facilities (Ranson 1991,1).

Generally speaking, the adequacy of housing is determined by the quality of the surrounding environment (or external factors) and by specific qualities of the dwelling (or internal factors). External factors are those that determine the characteristics of the surrounding environment and, because of their complexity, are out of the reach of the individual household for modification. External factors include location, neighborhood quality, access to community facilities (schools, health centers, recreation centers, shopping centers), and urban infrastructure or environmental factors (Lieder 1979).

Internal factors of housing quality are those factors for which the individual takes direct control. This direct control allows the individual or the household to take advantage of its economic resources to alter the dwelling and reach its housing needs. Internal factors basically refer to the specific characteristics of the dwelling. Those characteristics are the physical conditions of the structure and the services provided by the dwelling. The physical conditions include the type of materials in walls, roof, floors, ceiling, and the type of services include kitchen facilities, bathroom facilities, and other services such as dishwasher, laundry room, dryer, storage space, type of heating and cooling systems (Morris and Winter 1978; Harris 1976).

Lieder (1979) distinguishes the two factors of adequate housing by saying that ". . . [housing] is both shelter and a link to the neighborhood and the larger community" (p. 614). More specifically, he maintains that aside from the dwelling, special attention has to be given to location when assessing housing adequacy because location determines urban life and the performance of the family within the urban context.

Morris and Winter (1978) agree with the idea that housing is part of the urban context. Housing ". . . provides the setting for many of the biological and social processes necessary to sustain life. It also symbolizes the status of the family to both the wider community and to the family itself" (pp. 7-8). The desirability equation used by families to obtain the right kind of house includes neighborhood qualities and housing qualities. Nevertheless, Morris and Winter (1978) concentrate on the analysis of housing quality and its direct effect on the family and the family's housing behavior.

Based on minimum standards, a house is considered inadequate if, for example, the household spends more than 25 percent of its total income on housing, and the dwelling contains hazards such as faulty wiring, low-quality material in its structure. The house is also considered inadequate if residents do not have the opportunity to chose the house that best fits them in a neighborhood that offers enough security, pollution control (noise, traffic, air, and water), and adequate community health (protection from epidemics, unsafe water, and any other health threats). Furthermore, the house is considered inadequate if access to community services and facilities such as transportation and solid-waste collection is limited (Lieder 1979).

From the viewpoint of the household, a dwelling is adequate if its characteristics satisfy the needs and preferences of the household members. There might be, however, familial or economic constraitns that prevent households from obtaining the house that fits them best (Morris and Winter 1975; Brink and Johnston 1979).

Importance of housing adequacy

The concept of adequacy has been important at least since the beginning of the industrialization period, when cities began to experience crowding and crime problems, and urban dwellers began to experience physical and mental health problems (Abrams 1964). The distinction between housing characteristics and neighborhood characteristics is important in studying housing issues in cities where urban infrastructure is minimal or non-existent. This study explores a combination of housing quality and neighborhood quality within the context of developing countries by classifying specific characteristics of the dwelling, and specific characteristics of the neighborhood in different groups.

Factors related to housing adequacy

The forgoing review of literature leads to the conclusion that adequate housing is related to the conditions of the dwelling, the conditions of the neighborhood and to the of the community as whole. Thus, adequate housing depends on the ability of the resident to adjust to the present housing conditions or to move to a different house in the process of adjustment (Brink and Johnston 1973; Crull 1979).

Most families have dreams about the home they would like to have, and most of the time they have a practical list of things and features they would like to see in that home (Winter and Morris 1977). However, if families are unable to obtain the house they want, a deficit is perceived and satisfaction decreases. If the deficit is salient, families are likely to engage in a process of adjustment that can be of three forms:

residential mobility, residential adaptation, or family adaptation (Morris and Winter 1975, 79). If adjustment is not effective in reaching housing goals, a conflict may arise which, in turn, forces the household to change its norms to make them less demanding, or to engage in social action (Morris and Winter 1985).

In the United States, low residential satisfaction is regarded as a major factor in residential mobility (Crull 1979). In developing countries, families adjust their housing by altering the housing conditions or adapting to the present conditions rather than moving to a different house (Garcia, Murphy, Rees, Selby, Morris, and Winter 1990; Marcussen 1990; Bazant 1988). A common explanation of housing behavior among poor people in developing countries is that for most families owning a house is more important than renting towards the realization of a tolerable, if not decent, life (Palacios-Echeverria 1990b). Another explanation is that, because renting is not within the reach of the low-income families, they are forced to remain where they live regardless of the conditions of the dwelling and neighborhood (Gilbert and Varley 1989).

In a crosscultural study, Morris, Winter, and Murphy (1988) found that home ownership comes earlier in the formation of Oaxacan households than it does in U.S. households. The researchers also found that the propensity to move is high among Oaxacan families ". . . 21 percent of the families interviewed have at least thought about moving and 8 percent have definite plans to move within a year. . . the percentage is, nevertheless, considerably less than the percentage with a propensity to make alterations and additions to the dwelling" (p.10).

Assessment of housing adequacy

Traditionally, housing has been defined as adequate or inadequate based on specific minimum standards set by researchers. Although minimum standards are important in determining the adequacy of housing, most cannot be quantified (Pynoos, Schafer, and Hartman 1973). Nevertheless, Connerly and Marans (1988) recognize that there is the need for new research to encompass both dimensions, the dwelling itself, and the neighborhood as an extension of the dwelling. Turner (1982) and Marcus and Sarkissian (1986) advocate that the residents' own perception be accounted for in the determination of adequate housing. Thus, an ideal measure of housing adequacy has to consider the quality of the neighborhood, the access to community facilities, urban infrastructure, and the quality of the dwelling itself.

The self assessment of housing adequacy is the subjective evaluation of the objective characteristics of the dwelling (Morris and Winter 1978). The self assessment of housing adequacy allows the individual to compare housing expectations, housing aspirations, and previous experiences to his or her present housing conditions.

In this study, self assessment of housing adequacy is an adaptation of the Self-Anchoring Striving Scale, which is based on the idea that the resident's input is necessary to understand current conditions in different aspects of life (Cantril 1965). Cantril argues that, ". . . everyone has subjective standards which guide behavior and define satisfactions." But these standards, Cantril continues ". . . can change radically within an individual's life time so that what was once regarded as a goal may disappear or be taken

for granted as new sights come into play" (p. 21). In using this technique, Cantril expected to learn about those standards in the respondents' own terms, rather than in a pre-established set of options reflecting the researcher's standards. The responses, therefore, are based on assumptions that the respondent has built up, taking into consideration past experiences and the neighborhood were he or she lives.

Model and Hypotheses

The conceptual model for this study (Figure 3.1) shows that:

1. Socioeconomic and demographic factors and the location factor influence the objective quality of the dwelling

2. Socioeconomic and demographic factors and the location factor influence the availability of urban infrastructure

3. With socioeconomic and demographic factors and the location factor controlled, the objective quality of the dwelling, and the availability of urban infrastructure influence the subjective quality of the dwelling.

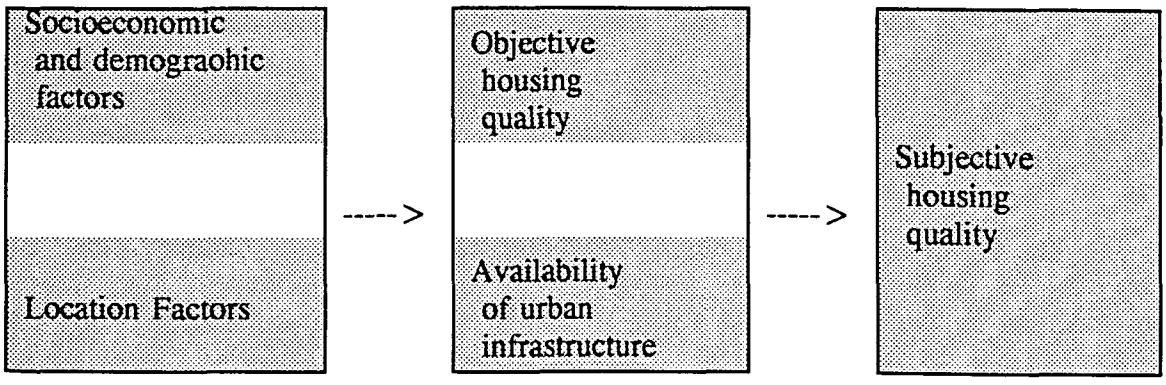

Figure 3.1 The conceptual Model

CHAPTER 4. MATERIALS AND METHODS

In this chapter, the data, the model to be tested, and the variables for the study are presented. The chapter ends with a preliminary discussion of the analytical procedures followed.

The Data

Statistical and ethnographic data gathered in 1987, 1989, and 1992 are used for this analysis. The author of this study participated as in the collection of the 1987 data, visited the city in 1989, and collected data in 1992 as a complement of the 1987 data.

The data for this analysis are composed of two portions, the data gathered in 1987, and the data gathered in 1992. The 1987 data were gathered during the first five months of that year in the city of Oaxaca de Juárez, Oaxaca, Mexico, as part of the project, "A Decade of Change in Oaxaca, 1977-1987." The purpose of that project, funded by the National Science Foundation, was to assess the effects of the macroeconomic changes in Mexico and in Oaxaca during the 1977-1987 decade on a sample of Oaxacan households.

The sample for the 1987 data was a two stage cluster sample of the city. The first stage consisted of a random sample of blocks from each of the 54 sectors in which the city is divided for property-tax purposes. Roughly 3600 households were living on the blocks selected, of which about 800 of the occupied dwellings were selected for

interviewing. Accounting for ineligible households (those with a male head without a spouse), refusals, sickness, and absence, it was expected that interviews would be completed with about 500 households. The completion rate was higher than anticipated as interviews were completed with 630 households. In each of these households, an interview was completed with the female household head, defined as either a single female with no male partner heading a household by herself or the adult female in a household headed by a male-female couple. An interview was also completed with the male household head when available.

The interviews were conducted by a team of Mexican interviewers who received about 10 hours of training prior to the interviewing. Each interview lasted approximately one hour. Data were coded, checked and entered into a computer data set during April and May of 1987.

In 1989, the author of this study participated in a study about illness evaluation and patterns of medical choice among people in "Colonia Volcanes," a low-income neighborhood of Oaxaca City. Personal contact with the people of Colonia Volcanes revealed that the provision of services in the city had not changed very much from that of 1987. There were still dwellings that did not received public services and dwellings that had the infrastructure, but with inadequate service. People often reported, for example, that they had water in their dwellings. Having water in their dwellings, however, sometimes meant having water for few hours during specific days of the week. In most cases, water was not suitable for drinking. Others reported that their dwellings were

connected to the municipal sewer system, but had rarely used it because the water supply was insufficient.

During January and April of 1992, data was collected as a complement to the 1987 data. Permission from the ISU Human Subjects Committee was obtained to conduct research in Oaxaca in 1992 as part of the project "Households in Oaxaca and Mexico's Crisis." These data concerned the availability of urban infrastructure in 1987 in each one of the 107 colonias (neighborhoods) in the sample. Data were obtained regarding the availability of water, sewer, street paving, transportation, and solid waste disposal. In addition, each colonia was assigned a number representing its distance from the city center. Initially, official institutions in Oaxaca City were contacted to obtain the information. Due to administrative and time constraints, only the local department of municipal services provided information regarding solid waste collection. Thus, a second strategy was implemented that included interviewing the presidents of colonias and the residents themselves. Presidents of colonias are members of the community, elected by residents to represent them in public affairs.

First, a list of all colonias having telephone service was obtained from a local private company, and at least one resident was called to collect the information. The list of colonias included the names and addresses of users, and the date when the telephone service was installed. Informants were selected from the list according to the date the service was installed in their residence. Thus, if the first resident in a specific colonia got the service in January of 1970, for example, he or she was selected; if information

was not obtained from that individual, a second resident was selected in the same manner. Interviews were conducted and information was gathered for 27 of the 107 colonias in the sample. Three of the 27 interviews were conducted with presidents of the colonia; the rest were with residents.

The second step involved a personal visit to each one of the 80 remaining colonias. Again, the information was gathered by interviewing presidents of colonias and residents. The input from colonia residents was obtained for 95 colonias both by telephone and personal visit. Twelve respondents were colonia presidents, nine of whom were interviewed in person. Ethnographic procedures, including face-to-face interviews, were used to collect the information. Oral and graphic data were recorded about public services in different sections of the city. The 1992 data were checked, coded, and added to the 1987 data during June of 1992. A total of 601 cases were available for this study.

The Empirical Model

The empirical model for this study, illustrated in Figure 4.1, is used to analyze the effect of availability of urban infrastructure on the self assessment of housing adequacy among owners and renters in the formal and the informal sectors. Specifically, the literature suggests that, while the conceptual hypotheses seem logical, there may be differences according to tenure of the dwelling and sector of participation. Thus, the conceptual hypotheses will be tested empirically controlling for sector of participation and

tenure of the dwelling (formal sector owners, formal sector renters, informal sector owners, and informal sector renters). More specifically:

1. Age of the woman, socioeconomic status, household size, and distance from the city center influence the objective housing quality

2. Age of the woman, socioeconomic status of the household, and distance from the city center influence the provision of urban infrastructure

3. With age, household size, socioeconomic status, and distance from the city center controlled, housing quality and availability of urban infrastructure influence the self assessment of housing adequacy.

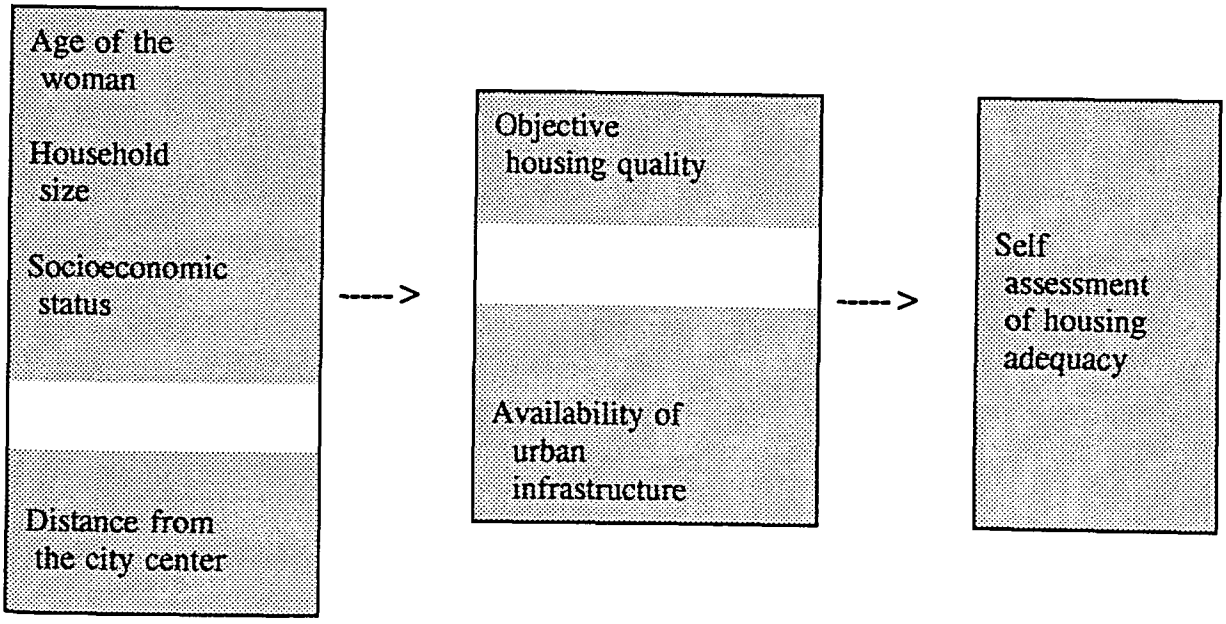

Figure 4.1 Empirical model

The Variables

Classification variables

The literature shows that, there may be differences in housing and household characteristics between formal and informal sector participants, and between owners and renters in both sectors. Therefore, sector and tenure of the dwelling are used to classify respondents into four different groups: formal sector owners, formal sector renters, informal sector owners and informal sector renters.

Sector Sector indicates whether any of the household members receive job-related services and benefits. Job-related services and benefits are those covered under the social security system and include the worker's protection against disability, unemployment, sickness, and accidents. Under the social security system, large industries are also required to provide housing, schools and public services (Aguilar 1990). Households who reported having at least one member currently receiving benefits from an employer were considered to be in the formal sector, the rest were considered to be in the informal sector. Of the total sample, 250 households (42%) are classified in the formal sector, and 351 (58%) are classified in the informal sector.

Tenure of the dwelling Tenure of the dwelling was originally defined in three categories: owner, renter, and free dweller. The owner of the dwelling is the person who possesses a legal title of the house or who inherited or acquired it by other means, but does not have a legal document. Owners were coded "1." People who rented and those who lived free at the time of the interview were coded "0." Of the total sample, 473

households (70%) own the house they lived in, and 178 households (30%) are renters.

Control variables

The control variables include the socioeconomic and demographic characteristics of the woman and her household that have been shown to influence housing quality. The variables included are age, household size, and the socioeconomic status of the household. Distance from the center of the city is also a control variable because of its relation to the provision of services.

Age of the woman In this study, age of the woman is the age in years of the female head of the household in years at the time of the interview. For the entire sample, the age of the woman ranges from 16 to 97 years, and the mean is 39.94 years with a standard deviation of 13.63 years.

Household size This variable is defined as the total number of people who were living in the same dwelling and those who were absent on January 1, 1987, but who otherwise lived in the same house. The mean household size is 5.55 for the entire sample, the median is 5 and the mode is 4.

Socioeconomic status of the household This variable is a composite based on monthly household income, education of the woman, number of workers, and level-of-living score. Education of the woman is measured by the number of years of school completed by the respondent. Years of school completed by the respondent for the entire sample range from 0 to 21, with a mean of 5.48 and a standard deviation of 4.66.

Monthly household income is the sum of the incomes for each one of the members of the household employed at the time of the interview. The exchange rate at the time of the interview was $1000 pesos to the dollar; the minimum wage was $2,500 pesos per day. The mean household income for the entire sample is $162,120 pesos per month, with a standard deviation of $140,040 pesos per month.

The level of living is calculated by adding the number of appliances and furniture present in the dwelling. It ranges from 0 to 21. The mean level of living for the entire population is 6.59, the median and more are equal 7.00.

Number of workers is the fourth variable used to assess the general socioeconomic status of the household. For this study, working people are all those members who contribute to the household expenditures. It is important to note that in most Latin American countries, the work force of the informal sector is joined by children of different ages who perform activities not reflected in the government economic programs. Some of the informal sector activities are shoe polishing, snack-food selling and the like.

The mean number of workers per household for the entire sample is 1.852; the median is 2.0 and the mode is 1. Of the households in the entire sample, 44 percent have one worker, and 43 percent have between 2 and 4 workers.

The four variables were first individually standardized by subtracting the mean and dividing by the standard deviation of the distribution. The resulting conversions yielded a mean of 0 and a standard deviation of 1. The four variables were summed and forced to be positive by adding 5, a linear transformation that only affects the magnitude

of the mean. The socioeconomic status of the household for the entire sample ranges from 3.65 to 7.95. The mean score is 5.00 with a standard deviation of 0.62.

Distance from the center of the city Distance is an important factor in Oaxaca because of its relationship to the concentration of economic activities in the central area. In terms of housing, distance is an indication of where people live and under what conditions (Murphy and Stepick 1991). This variable is the distance in miles from the main square of the city to each of the colonias. The distance was obtained using a city map provided by the property-tax department of the state department of finance and a proper scale to spot the colonias. The mean distance for the entire sample is 2.05 with a standard deviation of 0.83.

Intervening variables

Two composite variables are used to test the general hypothesis of this study: (1) objective housing quality, and (2) availability of urban infrastructure. The objective housing quality variable has been used in the past to predict the subjective perception of housing adequacy (Strickland, 1990). The availability of urban infrastructure, on the other hand, has not been employed as a measure of adequacy in housing. The two variables are expected to influence the respondent's ranking of her dwelling when other characteristics of the household are controlled.

Housing quality This variable is one of the composite variables and is made up of eight individual variables measuring the objective quality of facilities available in

the dwelling and the principal materials used in the construction of the dwelling. The items included are the kind of kitchen and bathroom facilities, main fuel used for cooking, the principal material in walls, roof, floor, and windows, and number of water heaters used.

Responses for each question were first classified as adequate and inadequate. The term adequate in this study is defined as: ". . . the condition which will provide a safe and healthy housing environment for its inhabitants" (Ranson 1991, 1). The principal material in the walls, for example, is considered adequate if the principal material in the walls was treated wood, adobe, or concrete. If the principal material in the walls was composed of plastic, cardboard, reeds, tin, bamboo, or other temporary materials the wall is considered inadequate. In another example, bathroom facilities in a dwelling were classified as adequate only if a toilet was available; otherwise bathroom facilities were classified as inadequate.

Inadequacy for the eight items was coded "0" and adequacy was coded "1". The eight items were added together to obtain a housing quality score with "0" being the lowest and "8" the highest. The mean housing quality is 3.86 for the entire sample with a standard deviation of 2.31.

Availability of urban infrastructure This variable is the other composite variable accounting for the general quality of the dwelling. The availability of urban infrastructure variable was constructed by adding three other variables: presence of a public water system, presence of a public sewer system, and the presence of paved

streets. The presence of water and sewer systems and the presence of paved streets was measured by asking the informant whether each of these public services existed in 1987.

The standard question asked was "Please tell me if (service) was available in 1987 for this colonia." Responses for availability of water, sewage, and paving were coded "0" if the specific service was not available in the colonia, and "1" if the colonia had the service. The sum of the items is a score of availability with "0" being the lowest, and "3" the highest. The mean for the entire sample is 1.77 with a standard deviation of 1.03.

Informants were also asked whether solid-waste collection and transportation existed in 1987. For the purpose of this study, solid-waste collection and transportation were considered available if the service was within or at the margin of the colonia, or within 10 minutes walking time. Of the total sample, 52 percent of the informants reported having access to the solid-waste collection service.

Transportation, on the other hand, is a service to which most informants reported having access. Thus, data regarding presence of transportation is not relevant for comparative purposes as it is constant, and therefore, was excluded.

There are some limitations among the infrastructure variables that must be mentioned. First, in 1992, the data on infrastructure were not gathered in the same systematic fashion as in 1987 and, therefore, the process did not involve the people who participated in the survey of that year. Second, even though data were gathered for the 107 colonias of the 1987 sample, not all of them were visited in person, but rather respondents were contacted by telephone in some cases. And third, a maximum of two

people were interviewed in each colonia regarding the availability of services five years ago. The elapse of time is of concern, since people tend to forget things as time passes.

The three limitations mentioned are the result of the conditions in which the data gathering process unfolded. The procedure used to collect the data for this study was part of a strategic plan created after a previous one, which consisted of obtaining the data from local agencies, failed due to bureaucratic policies and administrative constraints. Initially, all public officials contacted agreed to provide the data needed for the study. Nevertheless, the release of information, in most cases, had to be approved by other top officials, who questioned the purpose of the study, and thereby, delayed the process. In other cases, the approval to release the information was obtained, but the compilation of the data could not be done within the time-frame available.

As a result, the second strategy was implemented. In this process, direct contact was considered necessary for two reasons: to examine the physical appearance of the neighborhoods in the city, and to try to understand some of the problems confronting the people of Oaxaca. Traditional anthropological methodology suggests that direct contact with the people is essential when conducting field research. Friedl and Whiteford (1988) think that whatever a field worker is studying can be understood better when an effort is made to understand other aspects of life through "participant observation" (p. 88-89).

In regard to the accuracy of the data being gathered, on all occasions the researcher checked the responses of those interviewed against his knowledge of a particular colonia. When there was doubt about a specific answer, a second respondent

was interviewed. At the end, a double-check was done with an interviewer who also participated in the 1987 survey. There was no need to interview more people per colonia because even though there were only five questions asked in 1992, a state of rapport was established between the researcher and respondents to obtain accurate information. During the time of the interview, a routine introduction was made, and the respondent was asked whether specific services existed in 1987. When there was doubt, other questions were asked to refresh respondents' minds. They were secondary questions such as "When did you first move to the colonia?" "How long have you been paying for water?" or "How much did you pay for water and sewer last year, and the year before?" etc. Each interview lasted between 10 and 15 minutes.

There is no question that the data collected in 1992 would have a margin of error. It is especially difficult to ask someone else to remember the condition of the services five years ago, but the procedures followed represent the optimization of methodological resources available at that time in the city of Oaxaca.

Availability of urban infrastructure squared This variable is the squared term of the availability of urban infrastructure variable. It was created because preliminary analysis showed a curvilinear relationship between the availability of urban infrastructure and the self-assessment of housing adequacy.

Dependent variable

The dependent variable in this model is the reported self-assessment of housing adequacy. The variable measures the subjective quality of the dwelling based on personal experience of the respondent. Housing adequacy was assessed by asking the respondent toy rank her housing situation in a scale from 1 to 10. The woman was shown a picture of a ladder with ten steps, with 10 being the highest and 1 the lowest. Then she was asked, "Considering that 10 in the ladder is the best housing situation for you and the members of your household, and 1 is the worst, where would you put your household's housing on the ladder?"

The technique used to measure the dependent variable is known as the "Self-Anchoring String Scale" (Cantril 1965). The measure was first used to assess how people felt about different aspects of life in various countries in their own terms. The responses, therefore, are based on assumptions that the respondent has created taking into consideration past experiences and the neighborhood were she lives. The self anchoring scale was adapted in the 1987 survey to assess how people felt about their housing and other aspects of their life. The mean housing adequacy score for the whole sample is 5.24 and the standard deviation is 2.02.

Method of Analysis

The data for this study were analyzed using the Statistical Package for the Social Sciences (Norusis, 1988). Frequencies were examined for all variables and missing data

along with extreme cases were recoded to minimize their effect in the regression analysis. Cross tabulations were used for preliminary analysis to observe strength and direction of relationships. Correlations between pairs of variables to be combined into single variables were calculated with the Pearson Product Moment Correlation procedure.

A correlation matrix was calculated for the formal sector sample and the informal sector sample. Of all the independent variables, only distance from the city center and availability of urban infrastructure appear to be highly correlated with one another.

A method sometimes used to deal with the problem of intercorrelation is to omit the variables that are highly correlated with others, assuming them to be of equal predictive ability. Preliminary analyses indicate that the two variables were necessary to the analysis of the dependent variable, and thus they were retained.

Least squares regression is used to test the effects of the control variables and the general housing quality variables on the self assessment of housing adequacy.

The statistics that are used to evaluate the equations include the coefficient of multiple determination (R-squared), which is the percentage of the variance in the dependent variable explained by the independent variables. The t-tests associated with the coefficients are used to assess the significance of the relationship.

CHAPTER 5. THE ANALYSIS

The purpose of this chapter is to report the results of the analysis. First, the results of the descriptive analysis are presented according to sector and tenure of the dwelling. Then, the zero-order correlations among all pairs of variables are discussed. The last section is devoted to the regression analysis.

Descriptive Analysis

Control variables

All control variables are described in this section, including age of woman, household size, socioeconomic status, and distance from the center of the city. In addition, the education of the woman, monthly income, level of living, and the number of workers, which, together form the socioeconomic status variable, are discussed.

Age of the woman The mean age of women for the entire sample is 39.94 years (Table 5.1). Women who are owners are older than renters in the two sector samples. Women in the informal sector households are significantly older than women in formal sector households. The mean age of women who are owners in the formal sector is 40.30 years, while the mean age for renters is 32.60. For women whose households are in the informal sector, the mean age is 44.06 for owners and 34.81 for renters.

Household size The average household size for the entire sample is 5.55 (Table 5.1). Owners have larger households than do renters in each sector. Owners in

Table 5.1. Means and standard deviations of demographic and socioeconomic characteristics of the household, and distance from the center of the city

Variables		Formal sector		Informal sector		Total
		Owners	Renters	Owners	Renters	
Age of the woman[acdf]	MEAN	40.30	32.60	44.06	34.81	39.94
	SD	13.42	11.73	13.13	12.69	13.63
Household size[ad]		5.77	4.48	5.90	5.14	5.55
		2.46	1.49	2.56	2.47	2.46
Socioeconomic status[bcde]		5.22	5.20	4.87	4.80	5.00
		0.60	0.66	0.59	0.58	0.63
Education[bcdef]		7.19	8.64	3.47	5.12	5.48
		4.91	4.88	3.65	3.89	4.66
Monthly income in 000s of pesos[de]		181.67	202.72	149.31	142.14	164.12
		113.02	203.89	118.07	164.86	140.04
Level of living score[bcef]		7.82	6.92	6.19	5.19	6.59
		2.61	2.56	2.77	2.62	2.81
Number of workers in the household[d]		1.80	1.56	2.00	1.78	1.85
		0.92	0.74	1.21	1.02	1.05
Distance from the city center, in miles[acdf]		2.16	1.73	2.16	1.81	2.05
		0.79	0.82	0.80	0.86	0.83
	N	176	74	247	104	601
	%	29	13	41	17	100

Differences are significant at $P < 0.05$ between:
[a]formal sector owners and formal sector renters
[b]formal sector owners informal sector owners
[c]formal sector owners and informal sector renters
[d]formal sector renters and informal sector owners
[e]formal sector enters and informal sector renters
[f]informal sector owners and informal sector renters

the informal sector, however, have an average of 5.90 members per household, compared to 5.77 for their counterparts in the formal sector. Significant differences are found between owners and renters in the formal sector, and between formal sector renters and informal sector owners.

Socioeconomic status of the household The mean socioeconomic status for the whole sample is 5.00. In general, owners in both formal and informal sectors are better off than renters. Owners in the formal sector, however, enjoy a better socioeconomic status than owners and renters of the informal sector. When looking at the informal sector sample only, both owners and renters have lower socioeconomic status than that shown for the combined sample. Although the mean socioeconomic status for owners is higher than the mean for renters in both sectors, the differences are not statistically significant. The average socioeconomic status is 5.22 and 4.87 for owners in the formal sector and owners in the informal sector respectively.

Education of the female head of the household The level of education of the woman for the combined sample is 5.48 (Table 5.1). It is higher for renters than it is for owners in both sectors. Informal sector owners have the lowest level of education. Differences between each pair of groups are significant except for owners and renters in the formal sector. The average number of years of education for owners in the formal sector is 7.19, significantly higher than the average completed years of education for informal sector owners, which equals 3.47 years.

Monthly household income Of the four groups, renters in the formal sector have higher incomes than do owners in both sectors. They also have higher income than renters in the informal sector. In the informal sector, owners report having greater income than renters. Significant differences, however, are found only between renters in the formal sector and owners and renters of the informal sector. The average monthly household income for formal sector renters is $202,720 pesos, the average monthly income for a household in the informal sector is $149,310 and $142,140 pesos for owners and renters respectively (Table 5.1).

Level of living For the entire sample, the mean level of living is 6.59. When comparing the sector samples, it is observed that owners in the formal sector have significantly higher levels of living than owners in the informal sector. Significant differences for level of living can be observed between most pairs of groups, except between formal sector owners and renters, and between formal sector renters and informal sector owners.

Number of workers in the household According to Table 5.1, the work force is greater in the informal sector than in the formal sector. Traditionally, families in the informal sector have participated in the labor market more intensively because of their low level of education, few skills and almost no capital. These characteristics make informal sector people dependent on a labor market that is unstable by definition, but provides an opportunity for employment, even for a child (Roberts 1978). Generally, people in the informal sector, either owners or renters, report an

average number of working people per household slightly larger than that shown for owners and renters in the formal sector. Significant differences are only found between formal renters and informal owners.

Distance from the center of the city A clear pattern that can be observed from data on Table 5.1 is that renters in both sectors live closer to the center of the city than do owners. The average distance from the center of the city to a colonia is 1.73 and 1.81 miles for formal and informal sector renters respectively. This mean distance, however, for owners in either sector is the same--2.16 miles.

Although renting units can be found throughout the city, Oaxaca City, as many other cities in Latin America, has large concentrations of renters, particularly low-income people. As the city's population has increased, new housing has been provided in outlying areas of the city, but renting still predominates in the center.

In the outlying areas, ownership of the dwelling is more common either as a job-related benefit, or as part of invations. Individuals who participate in the formal sector normally will be provided with a housing united in well equipped neighborhood. Individuals outside the formal sector normally acquire the land first, then the construction of the house follows as the economic situation permits. Once the land is secured, a single room built out of temporary materials is constructed and the household moves in. A shelter of this type is, in most cases, referred to as a house, and claimed by the residents as their own even though the tenure of the dwelling may not be secured.

Housing quality variables

In this section, the objective quality of the housing and the availability of urban infrastructure variables are described. In addition, the component variables of the latter are also described.

Objective housing quality In general, owners enjoy a higher quality of housing than do informal sector renters. The housing quality score for formal sector owners is 4.75, and 4.58 for renters (Table 5.2). In the informal sector, the average housing quality score is 3.32 for owners and 3.12 for renters. Significant differences are found among all pairs of groups except between owners and renters in the formal sector and between formal renters and informal owners.

Availability of urban infrastructure The average availability score of urban infrastructure for the total sample is 1.77 (Table 5.2). Formal sector respondents have better chances than respondents in the informal sector of having urban infrastructure. They are more likely to live in housing developments where basic infrastructure is required under federal regulations, or have the means to move where that infrastructure is available. When comparing the scores between owners and renters, it can be seen that renters are more likely to have urban infrastructure in both sectors than do owners.

Not surprisingly, renters in the formal sector have higher scores for infrastructure than do their counterparts in the informal sector. Among the four groups, renters in the informal sector have the lowest mean score of availability of urban infrastructure.

Table 5.2. Means and standard deviations of housing quality, urban infrastructure variables, and the self assessment of housing adequacy

Variables		Formal sector		Informal sector		Total
		Owners	Renters	Owners	Renters	
Housing quality[bcef]	MEAN	4.75	4.58	3.32	3.12	3.86
	SD	2.32	2.22	2.25	1.79	2.31
Availability of public infrastructure[f]		1.84	2.19	1.48	2.03	1.77
		1.08	0.99	0.94	1.02	1.03
Have public water	%	87	92	87	90	88
Have public sewer[df]	%	60	76	43	69	56
Have paved streets[bdf]	%	38	51	18	43	32
Have solid-waste disposal service	%	56	65	43	69	52
Self assessment of housing adequacy[cf]		5.51	5.11	5.36	4.61	5.24
		1.91	2.17	1.99	2.08	2.02
N		176	74	247	104	601
%		29	13	41	17	100

Differences are significant at $P < 0.05$ between:
[a]formal sector owners and formal sector renters
[b]formal sector owners informal sector owners
[c]formal sector owners and informal sector renters
[d]formal sector renters and informal sector owners
[e]formal sector enters and informal sector renters
[f]informal sector owners and informal sector renters

Access to a public water system In the entire sample, 88 percent of the respondents have access to a water system. Having access to water does not differ between the two sectors. Eighty seven percent of owners in the formal sector have public water system in their colonia, which is the same percentage for owners in the informal sector. Although there is a slightly larger proportion of renters than owners in both sectors having this service, there are no significant differences among all groups.

Access to a public sewer system Only 56 percent of the sample have a public sewer system in their colonia. In the formal sector, 76 percent of renters are hooked up to the municipal sewer system. Sixty percent of owners are connected to the system. In the informal sector, 69 percent of the renters have a connection to a public sewer line, while only 43 percent of owners are connected to it. The largest difference is observed between owners and renters in the informal sector.

Having paved streets Paved streets are another element of infrastructure that reflects the well being of Oaxacans. Usually, paved streets are found in the central area of the city, or in government-sponsored housing complexes. Of the people in the entire sample, only 32 percent have paved streets in their colonia. When the sample is subdivided between formal and informal sector, renters in both sectors have higher percentages of paved streets than do owners. In the formal sector, 38 percent and 51 percent of owners and renters respectively, have paved streets in their colonia. In the informal sector, 43 percent of renters have paved streets, while only 18 percent of owners reported so.

Having access to a solid-waste collection service For the total sample, only 52 percent of the informants have access to the solid-waste collection service. According to Table 5.2, renters in both sectors have more access to the service than do owners in the two sector samples. Owners and renters in the formal sector sample have more access to the service than do owners and renters in the informal sector.

The dependent variable

Self-assessment of housing adequacy The mean score of the self assessment of housing adequacy for the entire sample is 5.24 (Table 5.2). When comparing the two sector samples, owners and renters in the formal sector report higher assessment score than do owners and renters in the informal sector. The mean score for formal sector owners is 5.51. For formal sector renters the mean score is 5.11. In the informal sector, the mean score is 5.36 and 4.61 for owners and renters respectively. In general, owners rank their dwellings higher than do renters. Nevertheless, significant differences are found only between formal and informal sector owners and informal sector renters.

Correlation Analyses

The zero-order correlation among all variables used in the regression analysis are presented in Tables 5.3 and 5.4. Only correlations significant at $p < 0.05$ are discussed. The squared term of the infrastructure variable is included to the correlation tables.

Table 5.3. Correlations among variables in the model for the formal sector sample (N=250)

	2	3	4	5	6	7	8
1. Age of the woman	0.26*	0.01	-0.13*	0.07	0.08	0.06	0.05
2. Household size		0.14*	0.07	-0.11	-0.10	-0.10	-0.12
3. Socioeconomic status			-0.17*	0.53*	0.30*	0.32*	0.35*
4. Distance from the city center				-0.31*	-0.60*	-0.64*	-0.14*
5. Housing quality .					0.55*	0.58*	0.38*
6. Availability of urban infrastructure						0.97*	0.24*
7. Availability of urban infrastructure squared							0.24*
8. Self assessment of housing adequacy							

According to Table 5.3 and Table 5.4, the age of the woman is not significantly correlated to the self-assessment of housing adequacy in the two sectors. In the formal sector sample (Table 5.3), age of the woman is positively correlated to household size and negatively correlated to distance from the center of the city. These correlations indicate that in the formal sector household, older women have larger households, and live closer to the city than do younger women. Age of the woman is not significantly correlated with any other variable in the informal sector.

Household size is positively correlated to the socioeconomic status of the household in both subsamples. The correlation value between household size and socioeconomic status for the informal sector sample is 0.33, higher than that for the

Table 5.4. Correlations among variables in the model for the informal sector sample (N=351)

	2	3	4	5	6	7	8
1. Age of the woman	0.08	0.02	-0.05	0.05	-0.02	-0.00	-0.02
2. Household size		0.33*	-0.03	-0.05	-0.03	-0.06	0.00
3. Socioeconomic status			-0.20*	0.43*	0.22*	0.21*	0.19*
4. Distance from the city center				-0.20*	-0.54*	-0.63*	-0.08
5. Housing quality					0.41*	0.40*	0.23*
6. Availability of urban infrastructure						0.96*	0.07
7. Availability of urban infrastructure squared							0.05
8. Self assessment of housing adequacy							

formal sector sample, which is 0.14. This finding is an indication that the well-being of households in the informal sector depends on larger numbers of household members participating in the labor market. The same relationship is found in the formal sector, but it is not as strong. Typically, in the formal sector, only the head of the household is employed to sustain the family; sometimes he or she is joined by his or her partner.

The socioeconomic status of the household in both subsamples is negatively correlated to distance from the center of the city and positively correlated to housing quality, availability of urban infrastructure, availability of urban infrastructure squared, and the self-assessment of housing adequacy. These findings indicate that respondents in either sector with high socioeconomic status live closer to the city, have better houses,

have access to more urban infrastructure, and, for that matter, rank their housing conditions higher than do respondents with low socioeconomic status. In general, individuals in the formal sector with high socioeconomic status have better housing than do their counterparts in the informal sector, a fact that is supported by the data in Tables 5.3 and 5.4. It is clear from this preliminary analysis that participating in the formal sector does make a difference. Having a secure income and receiving employment benefits allow households to improve the general well being of their families.

Distance from the center of the city in both formal and informal sector samples is negatively correlated to housing quality, availability of urban infrastructure, and the availability of urban infrastructure squared. In addition, in the formal sector, distance from the center of the city is also correlated with the self-assessment of housing adequacy. These correlations indicate that a family in the formal sector living close to the city is more likely to have better quality housing, have access to more urban infrastructure, and assess its housing higher than would a family living in the outskirts.

In the informal sector, distance from the center of the city is not significantly correlated to the self-assessment of housing adequacy. It is correlated, however, with housing quality and the availability of urban infrastructure. These correlations point out that among people in the informal sector, the objective quality of the residence and the availability of basic urban infrastructure are more important than the distance factor in assessing the quality of the dwelling.

Housing quality is positively correlated to availability of urban infrastructure, availability of urban infrastructure squared, and the self-assessment of housing adequacy in both formal and informal sector samples. Again, the correlation values for the formal sector sample are higher than for those in the informal sector sample. However, respondents in both samples with better houses have more public services available than do respondents with poor quality housing.

Availability of urban infrastructure is positively correlated to self-assessment of housing adequacy in the formal sector sample. In the informal sector sample, there is no correlation between the two variables. These findings indicate that respondents who have access to urban infrastructure are likely to take into consideration the services they receive from the city when assessing the adequacy of their dwelling.

Regression Analysis

Multiple regression analysis is used to assess the variation on the dependent variables explained by the independent variables. A total of twelve regressions were obtained for owners and renters in the formal and informal sectors. In the regression analyses, housing quality, availability of urban infrastructure and self assessment of housing adequacy are used as dependent variables.

The first eight regressions report the effect of household characteristics and distance from the city center on housing quality, and availability of urban infrastructure. The last four regressions predict the self-assessment of housing adequacy. The squared

term for the availability of urban infrastructure is introduced to test for quadratic effects when the self-assessment of housing adequacy acts as the dependent variable. A quadratic term was introduced in the equation after preliminary analysis reveled that a curviliniar relationship was present.

It is important to note that in the process of model construction, the solid-waste collection variable was deleted from the equation because it had no predictive, or explanatory significant qualities. In a first test of the model, the availability of urban infrastructure variable (composed of access to a water system, access to a sewer system, having paved streets and having a solid-waste collection service) was entered and it showed no significant relationship with the self assessment of housing adequacy.

Then, each of the variables making up the availability of urban infrastructure variable were entered in the equation as separate independent variables. In this step, the standardized regression coefficients, the "t" statistics and its significance were examined for all four variables to assess their partial contribution in explaining the self assessment of housing adequacy. After a throughout evaluation of the model, a final decision was made to not include the solid-waste collection variable in the regression equation because it was found that the variable was redundant.

Housing quality

When comparing the two sector samples, the coefficients of multiple determination (R^2) predicting the objective quality of the housing is higher for both owners and renters

in the formal sector sample than they are for owners and renters of the informal sector sample. The R^2 is 0.35 for owners and 0.53 for renters in the formal sector sample (Table 5.5). In the informal sector sample, R^2 is 0.31 for owners and 0.09 for renters These findings indicate that the control variables explain more variability in the quality of the housing in the formal sector sample than they do in the informal sector sample.

When looking at the sector samples separately, it can be seen that the R^2 for renters is higher than it is for owners in the formal sector. For the informal sector sample, however, the opposite results are obtained. These results indicate that the socioeconomic and demographic variables have a greater impact on the housing quality for renters than they do on the housing quality for owners in the formal sector, but the impact is greater on owners than renters in the informal sector.

According to Table 5.5, housing quality is affected by household size, socioeconomic status, and distance from the center of the city for owners in both sector samples. For renters in the formal sector sample, household size and socioeconomic status is significantly related to housing quality. For renters in the informal sector sample, only socioeconomic status is significantly related to housing quality. Among owners in both sectors, the positive regression coefficient of socioeconomic status and the negative regression coefficients of household size and distance from the city center, respectively mean that small households with high socioeconomic status who live close to the center have higher housing quality than do small households who have low levels of socioeconomic status and who live in the outskirts.

Table 5.5. Regression of housing quality on distance from the city center, and socioeconomic characteristics of the household, controlled for sector and tenure type

	Formal sector				Informal sector			
	Owners		Renters		Owners		Renters	
	beta	t	beta	t	beta	t	beta	t
Age of the woman	0.060	0.936	0.086	0.946	0.025	0.460	0.044	0.456
Household size	-0.170	-2.630**	-0.322	-3.660**	-0.249	-4.39*	-0.128	-1.247
Socioeconomic status	0.438	6.686*	0.627	7.58*	0.526	9.019*	0.316	3.089**
Distance from the city center	-0.297	-4.565*	-0.111	-1.284	-0.148	-2.658**	-0.032	-0.330
Constant	-1.748		-4.213		-4.416		-1.202	
R^2	0.35		0.53		0.31		0.09	
Adjusted R^2	0.34		0.51		0.30		0.06	
degrees of freedom	4 and 171		4 and 69		4 and 242		4 and 99	
F-ratio	23.119*		19.751*		27.198*		2.551**	

* $P<.0001$
** $P<.05$

Availability of urban infrastructure

The second dependent variable to be considered is the availability of urban infrastructure. Age of the head of the household, household size, the socioeconomic status of the household, and the distance from the center of the city are entered as determinants of availability of urban infrastructure.

Comparing the sector samples, it can be observed that both owners and renters in the formal sector sample have slightly larger coefficients of determination than do owners and renters in the informal sector. In the formal sector (Table 5.6), 37 percent and 47 percent of the variance in the availability of urban infrastructure is explained by the control variables as a group, for owners and renters respectively.

In the informal sector, 26 percent and 41 percent of the variance in the availability of urban infrastructure is explained by the socioeconomic and demographic variables and distance from the city center, for owners and renters respectively.

Among owners and renters in the formal sector, only the socioeconomic status of the household and distance from the center of the city have significant coefficients. They indicate that households with high socioeconomic status and those who live closer to the city enjoy more services than do households with low levels of socioeconomic status and those who live further away from the city center.

In the informal sector sample, the regression coefficients for socioeconomic status and for distance from the center of the city indicate that owners with high socioeconomic status, living close to the city have access to more urban infrastructure than do those owners with low socioeconomic status, living in the outskirts. Among renters, however, only the distance from the center of the city is significantly related to availability of urban infrastructure, meaning that renters in the informal sector living close to the center have access to more public services than do their counterparts living in colonias outside the central area.

Table 5.6. Regression of presence of urban infrastructure on distance from the city center, and socioeconomic characteristics of the household, controlled for sector and tenure type

Variables	Formal sector				Informal sector			
	Owners		Renters		Owners		Renters	
	beta	t	beta	t	beta	t	beta	t
Age of the woman	0.050	0.790	-0.032	-0.327	0.016	0.286	0.002	0.021
Household size	-0.103	-1.618	-0.081	-0.862	-0.100	-1.697	-0.044	-0.526
Socioeconomic status	0.228	3.527*	0.250	2.852**	0.219	3.621**	0.063	0.766
Distance from the city center	-0.499	-7.794**	-0.644	-7.643*	-0.413	-7.121*	-0.631	-8.083*
Constant	1.258		1.919		1.008		2.933	
R^2	0.37		0.47		0.26		0.41	
Adjusted R^2	0.36		0.44		0.24		0.39	
degrees of freedom	4 and 171		4 and 69		4 and 242		4 and 99	
F-ratio	25.124*		15.564*		20.830*		17.128*	

* P<000
** P<.05

In the city of Oaxaca, as in many other cities of Latin America, poor people still find rental housing in the central area of urban centers. Often, old houses in the center are modified or adapted to house individuals with limited resources. Commonly referred as "vecindades" in Oaxaca, these houses are characterized for having an open court-yard to which all of the families living in them have access. For the most part, families living in vecindades share sanitary facilities including

bathrooms and toilet facilities. They also share small washing places and have a common entrance into the complex.

Self assessment of housing adequacy

The last dependent variable to be considered is the self-assessment of housing adequacy. In addition to the initial control variables, housing quality, the presence of urban infrastructure, and the availability of urban infrastructure squared are entered into the regression equation as independent variables. The results of the regressions are presented in Table 5.7.

According to Table 5.7, the coefficients of multiple determination (R^2) are higher for owners and renters in the formal sector than they are for owners and renters in the informal sector. In comparing tenure of the dwelling in both sectors, Table 5.7 shows that 21 percent and 26 percent of the variance in the self-assessment of housing adequacy is explained by all the variables as a group for owner and renters respectively. In the informal sector sample, 10 percent and 8 percent of the variance in the self-assessment of housing adequacy is explained by the seven variables together for owners and renters respectively.

When looking at the standardized coefficients, different independent variables have different effects on the self-assessment of housing adequacy. For owners in the formal sector, for example, only the size and the socioeconomic status of the household are significantly related to the housing adequacy assessment. The effect of household size is negative, while the effect of socioeconomic status is positive,

Table 5.7. Regression of self assessment of housing adequacy on housing quality, availability of urban infrastructure, distance from the city center, and socioeconomic characteristics of the household, controlled for sector and tenure type

Variables	Formal sector				Informal sector			
	Owners		Renters		Owners		Renters	
	beta	t	beta	t	beta	t	beta	t
Age of the woman	-0.015	-0.213	0.125	1.055	-0.043	-0.692	-0.167	-1.683
Household size	-0.180	-2.441**	-0.089	-0.716	-0.029	-0.432	-0.105	-0.972
Socioeconomic status	0.203	2.478**	0.338	2.273**	0.094	1.207	0.160	1.461
Distance from the city center	-0.115	-1.281	0.038	0.248	-0.150	-1.913**	-0.034	-0.233
Housing quality	0.178	1.697	0.193	1.228	0.230	2.782**	-0.094	0.901
Availability of urban infrastructure	0.453	1.616	-0.006	-0.013	0.405	1.832***	-0.193	-0.447
Availability of urban infrastructure squared	-0.393	-1.281	-0.037	--0.079	-0.506	-2.122**	0.224	0.467
Constant	2.345		-1.714		4.110		3.198	
R^2	0.21		0.26		0.10		0.08	
Adjusted R^2	0.17		0.18		0.07		0.02	
degrees of freedom	7 and 168		7 and 66		7 and 239		7 and 96	
F-ratio	6.215*		3.264**		3.653**		1.235	

* P<000
** P<0.05
*** P<0.06

indicating that small households with high socioeconomic status rank the adequacy of their dwelling place higher than do large households with low socioeconomic status.

For renters in the formal sector, only the socioeconomic status of the household has an effect on the self-assessment of housing adequacy. The positive coefficient indicates that households with high socioeconomic status assess the adequacy of their dwelling higher than do households with low socioeconomic status.

In the informal sector sample, distance from the center of the city, housing quality, the availability of urban infrastructure, and the availability of urban infrastructure squared have significant coefficients. The effect of distance from the center of the city on the self-assessment of housing adequacy is negative and the effect of housing quality and the availability of urban infrastructure are positive. These findings indicate that households living close to the center of the city, with high housing quality and having access to most urban infrastructure, rank their housing higher than do those households living in outlying areas of the city with low housing quality and with a low score of availability of urban infrastructure.

The significant coefficient of the availability of urban infrastructure and its squared term show that a curviliniar relationship exists between availability of urban infrastructure and the self assessment of housing adequacy. The curviliniar relationship implies that as the level of urban infrastructure availability increases, the ranking of the dwelling's adequacy also increases, but only to a certain point after which, the assessment of the adequacy of the dwelling decreases.

Stimson, Carmines, and Zeller (1981) developed a method to estimate the lowest or highest value of the curve which corresponds to the value of the independent variable and the highest or lowest value of the dependent variable. The formula to calculate such value is $F=-b_1/2b_2$, where b_1 is the unstandardized coefficient for the independent variable, b_2 is the unstandardized coefficient of the independent variable squared, and F is the minimum or maximum value of the independent variable.

The resulting value in this case, after the computation of the formula, is 1.32, meaning that an inverse relationship between the availability of urban infrastructure and the self assessment of housing adequacy exists. This finding indicates that among owners in the informal sector, having access to urban infrastructure up to the 1.32 level is important in assessing the adequacy of the dwelling. After this point, access to urban infrastructure is irrelevant because the assessment of the dwelling decreases with each additional increase in the level of urban infrastructure availability.

The decrease on the assessment of the adequacy of the dwelling might be related to a quality factor. Research shows, for example, that inefficiency in water distribution and poor quality of the liquid forces people to rely on inadequate and expensive supplies from vendors and on private wells to satisfy their water needs. This situation, common among poor people of developing countries makes public systems unimportant and some times obsolete (Kirke and Arthur 1984). A good example of the inefficiency of public services delivery is expressed by Doña

Remedios, a resident of a neighborhood in Oaxaca who commented:

> . . . we don't care about the water or the garbage collection services because we never know when the water is going to be sent, nor do we know when are they going to pick up the garbage. We prefer to buy water from "pipas" [water trucks], and dispose the garbage on the edge of the river. . . we know it is not good for health, but they [the city] don't give us another choice (personal interview, 2 February 1992).

CHAPTER 6. SUMMARY AND CONCLUSION

The purpose of this study is to examine the effect of the availability of urban infrastructure on the assessment of housing adequacy by the resident respondent. The study explores the relationship between availability of urban infrastructure and the assessment of housing adequacy within four groups: formal sector owners, formal sector renters, informal sector owners, and informal sector renters.

Methods

The data for this study are composed of two portions, the 1987 portion and the 1992 portion. The 1987 portion is part of the project "A Decade of Change in Oaxaca, 1977-1987," available from the Department of Human Development and Family Studies, at Iowa State University, Ames Iowa. The second portion of data was gathered in 1992 and includes information about the availability of basic urban infrastructure such as water, sewer, solid-waste collection and paved streets for all the neighborhoods sampled in 1987. In addition, each colonia was assigned a number representing its distance from the city center. The analysis for this study is based on a total of 601 cases. The primary method of analysis used to examine the effect of independent variables on the dependent variable is multiple regression.

Major Findings

As hypothesized, there are differences in the assessment of housing adequacy according to sector of participation and tenure of the dwelling. In general, the empirical model tested explains better the assessment of housing adequacy among owners in the informal sector sample.

Housing quality

Housing quality among owners in the formal and informal sectors in the city of Oaxaca is a function of household size, socioeconomic status, and distance from the city center. Smaller households with higher socioeconomic status who live close to the city center have higher housing quality than do larger households with low socioeconomic status who live away from the city center.

Among renters in the formal sector, housing quality is a product of household size and socioeconomic status. Smaller households with higher socioeconomic status have higher housing quality than do larger households with lower socioeconomic status. For informal sector renters, only socioeconomic status affects housing quality. Age does not affect housing quality in any of the four groups.

Availability of urban infrastructure

The availability of urban infrastructure among owners in the formal and informal sectors is affected by the socioeconomic status and the distance from the city center. Owners with higher socioeconomic status living closer to the city center have

access to more services than do owners with lower socioeconomic status who live away from the city center. The availability of urban infrastructure is also affected by socioeconomic status and distance from the city center among informal sector renters.

For renters in the informal sector, however, the availability of urban infrastructure is a product of distance from the city center only. Renters living closer to the city have access to more urban infrastructure than do those living away from the city center.

Low-income people in the city of Oaxaca cannot afford paying for urban infrastructure because they are dependent on a labor market that does not offer them the opportunity to increase their good. In Oaxaca City, it is very common to hear low-income people talking about businesses, but for the most part, these businesses are low-scale and non-productive.

When low-income families are able to access basic urban infrastructure, it is generally of poor quality. Most residents of colonias reported that water always came muddy for the first-half hour. According to a water treatment expert[1], the water quality achieved through treatment prior to distribution in the city is considered acceptable, but a pollution problem arises later due to leakage, contamination of aquifers and poor maintenance of secondary storage tanks in different parts of the city, with the main pollution problem due to the aging of the present system.

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[1]Tad Morris, a plant operator for the Municipal Water Treatment Plant, in Ames Iowa, in the United States, visited the water treatment plant in Oaxaca during January of 1992. In an assessment of the facility, he considered the water treatment process to be acceptable.

In some of the areas of the city receiving water, individual elevated tanks, usually set on top of the houses, have become useless because there is not enough pressure to fill them. The immediate solution to this situation is the construction of an underground tank and the installation of a pumping system that only few can afford. According to some "colonos," the pressure of the water from the public system has diminished because the city is continuously expanding the water lines to new areas. The director of the water treatment plan, however, thinks that the main reason for this is the aging of the system which he says, was put in some 50 years ago, and it has not received any maintenance. He said,

> . . . people get small amounts of rusty water because all the system pipes have developed a thick crust of rust through the years and there is not much room for water to circulate. . .

Possibly more striking than the lack of sufficient water is the fact that the city does not have a sewage treatment plant. Commonly, sewage is disposed freely into water mains which later contaminate underground sources. In Oaxaca City, contamination of underground resources is evident because of the lack of a sewage treatment facility to dispose treated water into the rivers. A resident living near a sewage discharge area in Oaxaca City commented:

> . . . we used to have a deep well right in front of our house built by the government to the benefit of this colonia, but about 8 years after it was in service, the committee on water decided that the water was too dangerous for the colonia residents to use it because the well got contaminated. The color of that water was black and it had a bad smell. Then we all had to cooperate to dig another well because the government would not help us, but it was worth while. Now we have clean and drinkable water but do not drink it because the system is deficient and rusted. . .

Local officials, however, suggest that things are getting better. They consider that the administration of President Salinas de Gortari began one of the most successful programs where the residents become the core of the action. A government employee mentioned that:

> . . . it was not until 1989 that things started getting better here in Oaxaca and in the country. With the Programa Nacional de Solidaridad [PRONASOL (National Program for Solidarity)] we have done a lot. There are more colonias with services, more colonos requesting help, and more work for us, and I think everyone in the city feels that. . .

Self assessment of housing adequacy

The assessment of housing adequacy among owners in the formal sector is influenced only by household size and the socioeconomic status of the household. Owners with small households and high socioeconomic status rank the adequacy of their dwelling high.

Among owners in the informal sector, the assessment of housing adequacy is affected by distance from the city center, housing quality, availability of urban infrastructure and the availability of urban infrastructure squared. These findings indicate that those living closer to the city center, with higher housing quality and having access to more urban infrastructure rank their dwelling higher than do owners living away from the city center with lower housing quality and having limited access to urban infrastructure.

The negative coefficient for the squared term, however, indicates that the ranking of the dwelling's adequacy reaches a maximum point with a specific number

of services. After this point, the ranking of the house decreases. An explanation to this finding may be that among poor people in the city of Oaxaca, having access to a single service is better than nothing, but having access to more services may not be as important because of a quality factor. For the most part, water delivery and sewage treatment are deficient, and paving is limited or non-existent.

According to Oaxaca City's water treatment plant director, in spite of the high percentage of people receiving water, the liquid has to be rationed in order to serve all the neighborhoods that have the infrastructure. As the author of this study walked through different neighborhoods of the city, respondents reported that, in fact, water from the public system comes only a few hours during the day, three or four times a week, if they are lucky.

Conclusion

This study is by no means a final product, but rather the starting point for exploration of the importance of the provision of urban infrastructure and, for that matter, the importance of government intervention. This study shows that among owners of the informal sector, adequate housing from the point of view of the resident is, indeed, a function of housing quality and the availability of urban infrastructure.

The current situation in Oaxaca City is a good example of the interaction of government and residents to improve the residential areas in the city. Oaxacans in general seem better off than five years ago and colonias populares look better than in 1989, and even better than they did in 1987.

A key aspect in these improvements has been community participation. Señor Clemente, for example, was happy that the sidewalk on the street where he lives was being paved. "This is not all he said", showing a great deal of excitement, and continuing to talk as he poured the concrete on the sidewalk ". . . most people in this neighborhood are replacing their water connections to the public system, because we plan to paved the streets. . . the government has given us part of the materials and we provide the labor. It is a good help because we could not do it for ourselves."

People not only want services, they want good services and they are doing their part to improve them. In the city's new settlements, the situation is not much different from that of other neighborhoods; people are getting organized to obtain basic infrastructure and other community services to improve their living environments.

Implications for Further Research

This study used the self assessment of housing adequacy as the dependent variable, housing quality and urban infrastructure as intervening variables, and age, socioeconomic status, and distance from the center of the city as control variables. Equally important was the use of tenure and sector of participation to test the relationship between dependent and independent variables.

There might be some other variables, however, such as urban infrastructure quality, community participation, and disease incidence that could be added to the model to offer better explanations of the relationship between housing quality and

availability of urban infrastructure, and housing adequacy, particularly in the informal sector sample. Because urban infrastructure is generally of lower quality or nonexistent in squatter settlements than in other areas of the city, one could expect the health of the people living in them to deteriorate. Thus, further research is needed to better understand the patterns of adjustment adopted by low-income families when urban infrastructure is not available and family economic resources are limited. An understanding of these patterns could, perhaps, direct action to implement programs either with government or other type external assistance to better the conditions of people in the informal sector.

Implications for Policy Makers

The present study, and more specifically, the results of the analysis reinforce the idea that cooperative efforts of the household, the community, and the government are needed to improve housing conditions among Oaxacans. Because families by themselves can not provide urban infrastructure, the government or any other external entity must work closely with the residents in order to understand the mechanisms employed by informal sector people to create more meaningful programs. By identifying groups that are concerned about services, the government could set priorities and direct programs and resources to neighborhoods willing to cooperate in improving their environments. One way of eliminating the barriers to the provision of adequate housing is by integrating the resident's potential for development, and that is his or her commitment to work in community.

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