A CROSS-SECTION ANALYSIS OF THE DEMAND FOR MOBILE HOMES IN FLORIDA

By

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DEDICATION

This work is dedicated to the glory of God who "showed His great love for us by sending Christ to die for us while we were still sinners" so that whatever we do, it may be for the glory of God.

(Romans 5:8, I Corinthians 10:31, TLB)

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Over the years a considerable amount of economic work has been generated which seeks to ascertain the income elasticity of demand for housing. The work done here builds upon this literature by applying regression analysis to the mobile-home sector of the housing market--a sector which has been growing rapidly in the last two decades and now accounts for virtually all the "low-cost" housing currently being produced in the United States.

The economic literature on housing demand is reviewed; income elasticities of demand for conventional housing are found to range from 0.15 to 2.4. Such a wide range apparently results from the use of different data, different methodologies, and different definitions of both income and housing expenditures by the individual researchers.

Two housing demand models for mobile homes are then developed. Both models are estimated using data from the 1970 Public Use Sample for Florida. The first examines the demographic variables which influence home ownership and mobile-home ownership. Generally, the same variables are found to be significant for predicting home ownership in general and for predicting ownership of a mobile home, but often the influences are in opposite directions. For instance, home ownership is found to be positively related to observed income but mobile-home ownership is found to be inversely related to observed income. This inverse relationship was found for most of the variables used in the first model developed.

The second model regresses mobile home housing expense against income. Four measures of income are utilized. One is observed income and the other three are alternative formulations of permanent income. Income elasticity is found to be less than unity in all cases--never rising above 0.50. Elasticities for renters of mobile homes are found to be lower than those for owners of mobile homes. No blanket statements concerning the preferability of permanent income over observed income for determining mobile-home housing expenditure can safely be made on the basis of the results of the models developed in this work. It was found, however, that use of permanent income as the

income variable did yield higher income elasticities than were found when observed income was the income variable used. In fact, the income elasticity appears to be moderately sensitive to the measure of income used.

Demographic variables were not very often helpful in explaining variation in mobile-home expenditures. Price, income and family size were the variables which most often were found to be of explanatory significance. Older Floridians were found to own a large percentage of the owner-occupied mobile homes, especially in south Florida. Nonwhites make very little use of this form of housing, even though mobile homes are relatively low-cost housing and nonwhites have below-average incomes.

The second model was also estimated for renters of mobile homes. The results were less satisfying in a statistical sense, but it appears that rental expenditures are less closely related to income than are owner's expenditures. It seems that renting a mobile home was a temporary housing choice for many of those who were renting in 1970.

CHAPTER I
INTRODUCTION

General Setting: Housing Needs and Alternatives

The Housing and Urban Development Act of 1968 set a national goal of providing 26 million new and rehabilitated housing units during the fiscal 1969-78 decade. This goal may have been unobtainable even under the best of conditions. In any event, the economic conditions of the early and mid 1970s have made its achievement virtually impossible. One bright spot in recent housing experience, however, is the growing role played by mobile homes in providing decent housing. This relatively new housing alternative appears to be one way of providing large numbers of housing units at relatively low costs.

Recent evidence of the growing role of mobile homes in the nation's housing stock is found in the U.S. Department of Housing and Urban Development's Newsletter of December 2, 1974 (Vol. 5, No. 48). Referring to the use of mobile homes as part of the effort by HUD under Section VIII of the 1974 Housing and Community Development Act to make housing available for low-income families, Sheldon Lubar, HUD Assistant Secretary for Housing Production

and Mortgage Credit-Federal Housing Administration Commissioner said:

> Under the new Act's provisions for leased housing, qualified families may choose to live in mobile homes, as well as other types of housing. As a matter of fact, in some parts of the country, with the use of mobile homes, families may be able to get a decent home and a suitable living environment considerably sooner than if they were to wait for the availability of conventional multi-family dwellings.

Clearly, costs of new conventional housing have risen to such a level that more consideration needs to be directed both to the supply of mobile homes and to the nature of demand for such housing. In support of this view one need note only that the median price of all conventionally built new single-family homes sold in the United States in 1969 was $25,600. Median family income for the same year was $9,586. If the rule of thumb (applied to housing) of two and one-half times annual take home income for housing expenditure is applied, it can be seen that many families face severe budgetary problems in this respect. In fact, the Second Annual Report on National Housing Goals (1970) estimated that about one-half of all American families were unable to pay more than $15,000 for a home. And of the less-than-$15,000 single-family housing units produced in the late 1960s, 90 percent were mobile homes. This is largely attributable to the fact that the cost per square foot for mobile homes is less than half that for conventional structures. Since these 1970 figures were compiled,

the income-housing cost disparity has widened, causing the budgetary problems faced by many families to become more acute.

Housing Sector Demand

Until now primary emphasis in the analysis of the mobile home market has been concerned with the potential in helping to meet the housing needs of low-income families. It may be that this emphasis has obscured the possibility that the mobile-home market is broader and more complex than previously assumed. There are families which are not "poor" who do not wish to spend one-third of their income on housing.

The general purpose of the study is to begin a serious analysis of the market for mobile homes from the demand side. Clearly, policy prescriptions relating to mobile homes and their anticipated role in the nation's housing supply should be based upon sound economic studies of the owners and renters of mobile homes and the potential market. We need specific information about socio-economic characteristics and about budgetary patterns. For example, how do characteristics of owners and renters of mobile homes compare with those of home owners and renters in general? Are there only certain types of households who use mobile homes?

This study will build specifically upon the well-established literature in economics which deals with the demand for housing and will develop a cross-section analysis of the demand for mobile homes in Florida. The problem is an important one. The traditional housing demand literature in economics is relatively well-developed for conventional types of housing, but the applicability of such models to mobile-home housing is untested and at least needs study and exploration. It is not known what determinants figure into mobile home demand. A look at Florida's effective demand could prove useful elsewhere to the extent that these determinants are found elsewhere in the United States.

The objective of this study, then, is to estimate the demand for mobile homes in Florida, starting from the conceptual framework of the extensive literature in economics which deals with the demand for conventional housing. It has generally been assumed that since mobile homes constitute "low-cost" housing, it is primarily low-income families who live in them. This is probably true, but requires substantiation.

We need specific information with respect to the income elasticity of demand for mobile homes. Even for conventional housing, income elasticity is not a settled issued. Whereas Muth (1960) and Reid (1962) report elas-

ticities greater than unity with respect to permanent income, Lee (1968) states that it is less than unity for both his cross-sectional and time-series studies. As if these conflicting results were not unsettling enough, Maisel and Winnick (1960) tell us that housing consumption is no more responsive to permanent income than to changes in observed current income. Barth (1966) reaches a similar conclusion in developing a model of household behavior to predict whether a consuming unit will choose to buy a house. Even if these issues were settled ones, there is no reason to suppose that the findings which pertain to conventional housing would hold for mobile homes.

Research Design and Methodology

Florida is an area where the use of mobile homes is widespread. When looked at on a state-by-state basis, Florida is second in the number of mobile homes in use. Floridians do, indeed, make extensive use of mobile-home housing. To the extent that factors leading to this high level of usage are found elsewhere, future usage elsewhere might also be high. If the only relevant factors are peculiar to Florida, then application of this study will be limited. It is suspected, however, that changing tastes and increasing mobility are relevant factors in housing decisions. If this is so, Florida is a harbinger rather

than the exception to some rule. At any rate, with such widespread experience in the use of mobile home housing, Florida provides an excellent opportunity for study.

The primary data source for this dissertation research will be the Public Use Sample of Basic Records from the 1970 Census. This data base, collected on magnetic tape, is a one-in-a-hundred representative sample. For Florida there are approximately 25,000 household observations, about 1,700 of these being mobile-home households. Observations for states, county groups, and standard metropolitan statistical areas (SMSA) of 250,000 or more persons are available.[1] For each observation there are approximately 125 variables available in the Public Use Sample. The data format is such that n-dimensional cross tabulations are possible. This arrangement allows almost unlimited flexibility. For example, among those who live in mobile homes in St. Petersburg, Florida, various cross tabulations are feasible; e.g., by age, occupation, source of income, race, education, annual cost of water, or any other included variable. Data are broken down so that they are available for the entire state, for five major areas of the state, and for fourteen subareas including seven SMSAs.

This data base will make possible derivation of a demand function and an economic cross-section analysis of the demand for mobile homes in Florida. Cross-section

analysis of housing demand for the nation as a whole or for a particular geographic area is a well-established technique for conventional housing. Reid (1962) and Lee (1968) have done the most-cited work. De Leeuw (1971) has looked at these studies and several others in an attempt to see if their results are consistent. He concludes that there is more agreement about the empirical value of income elasticity of demand in these works than there appears to be on the surface. The applicability of conventional housing models is in question at this stage, however, since no one has specifically verified whether conventional housing factors apply to mobile-home housing.

In this respect, it appears that demographic variables require special attention. In terms of socio-economic factors it would seem worthwhile to differentiate between owners and renters in order to determine what influence the life cycle (i.e., age) has upon mobile-home consumption patterns, and to examine racial differences in consumption patterns. Have mobile homes made ownership more feasible for low-income families? Is the mobile home of any value as a means of dispersing minority racial groups from the central city and hence reducing the urban problems associated with culstering of low-income housing? Are the housing choices of in-migrants (e.g., recently relocated households) different from the potential renter

market or the home-owner market? We would want reliable answers to these questions before formulating housing policies which would include the use of mobile homes.

The approach utilized here will begin with a study of the relevant housing demand literature. The most important works will be considered and recent work on mobile-home housing will also be examined. Chapter III will explore housing expenditure as a household budgetary decision. Overall demand considerations will be introduced and a specific look at Florida's mobile-home usage pattern will be presented. Descriptive material will be used in making a comparison of Florida's and the nation's use of mobile homes. Owners will be separated from renters so that the relevant distinctions can be noted.

Models to be estimated are constructed and explained in Chapter IV. Model A, a tenure-choice model, and Model B, an expenditure model, are developed. Variables to be used in these models are introduced and the rationale for their consideration is discussed. Actual findings when the model is estimated are then presented in Chapter V. Important findings are pointed out and considered. Chapter VI then summarizes the study, noting relevant questions which must be left unanswered until further research is directed toward dealing with these matters.

Usefulness of Mobile-Home Demand Research

This research is an extension of the existing literature on housing demand. It is unique in that it deals with a sector of the housing market which has heretofore received almost no attention, even though it is a rapidly growing sector of the market. As will be pointed out, there seem to be reasons for this increased use of mobile homes which will insure their popularity in years to come. This is particularly true in Florida and some other parts of the United States also. One of these factors relates to family income, and this relationship is given special attention.

Implications of the findings of this study should prove useful in considering future housing policies which specifically include use of mobile homes. For instance, it would be desirable to know if some segments of our population to whom we desire to give housing assistance have strong feelings about the suitability of a mobile home. We already have costly experience in trying to house people in environments and housing styles which do not appeal to them (Pruitt-Igoe is probably the prime example).

Present housing programs, especially Section VIII of the 1974 Housing Act, indicate that mobile homes will, indeed, figure prominently in meeting future housing goals.

Programs to make mobile-home acquisitions by low-income families easier could perhaps facilitate achievement of these goals. Specific information about mobile-home demand is needed, however, before efficient programs incorporating their use can be drawn up. This study should supply some of the needed information which can help in shaping future national housing policies.

CHAPTER II
THE LITERATURE ON ESTIMATION OF ELASTICITY OF DEMAND FOR HOUSING

First Efforts

...rk traditionally cited as the first legitimate ...empt at empirical analysis of household expendi- ... published by Christian Lorenz Ernst Engel in ... data collected by Ducpetiaux for 153 Belgian ... his base, Engel proposed a law of consumption ... expenditures on food to a family's socio- ...me. He proposed that poorer families spend a ...ntage of their available assets on food than do ...milies. Carroll Wright "borrowed" a hypotheti- ... Saxony which Engel had drawn up, attributed ..., assigned expenditure figures to the three ... classes, and expanded Engel's generalization ...--dealing not only with expenditures for food, ...clothing, lodging, and sundries.*

...ter (1895) reexamined his Belgian data ac- ...me class and concluded that the proportion

*For detailed description of these events, see ...'s article in the April 1954 Journal of Politi-

of income or total expenditure spent on housing fell as income or total expenditures rose. Stigler (1954, p. 99) concludes from his study of these works that "Wright's 'translation,' for which I can find no satisfactory explanation, still forms the basis for most present-day statements about 'Engel's laws'." It seemed to Stigler that the relationship between income and housing which is usually referred to as Engel's Law had not been empirically verified.

Hermann Schwabe (1868, p. 266) proposed a consumption law relating specifically to housing: "The poorer anyone is, the greater the amount relative to his income that he must spend for housing." This law was based upon salary, income, and rent data for 14,022 observations in Germany. The generalization was found to hold for Leipzig (by Hassee) and Hamburg (by Laspeyres) and was accepted by Engel. Subsequent budgetary studies considered housing expenditures, but nothing of exceptional economic interest was generated until well into the twentieth century.

Table 1 lists the major housing studies published in the United States. Most of these are not discussed in this chapter, but all did make a contribution in the development of the body of housing-demand literature. A variety of data bases has been utilized in estimating demand for housing, and each researcher seems to have modified his approach to the issue in order to utilize the data he had. The studies are listed chronologically by data

TABLE 1
The Housing Literature on Estimation of Demand Elasticity

Researcher	Date Published	Data Source	Income Elasticity	Time Series or Cross Section Data	Renters or Owners	Comments
Ogburn	1919	200 D.C. family budgets	0.93	C	R	ungrouped data; η_y derived from regression coefficients
Allen	1942	Bureau of Labor Statistics Urban Study of Consumer Purchases, 1935-36	0.33-0.67	C	O	η_y = expenditure elasticity; 3000 observations from 5 east north central cities; H = housing + utilities; Y = total yearly income; house value included where appropriate; controls for family size and composition
Duesenberry & Kistin	1953	BLS; Spending & Saving in Wartime Bulletins 723 & 724, 1942	0.15	C	R,O	linear regression for aggregate data; Y = observed income
Winnick	1955	Grebler, Blank & Winnick, 1890-1950	0.5	T	O	macro data; H = per capita housing value or real value per dwelling
Prais & Houthakker	1955	1937-39 British surveys	0.83	C	R	semi-log Engel curve specification; H = rent expenditures; Y = yearly income of household head
Morton	1955	F.H.A. & National Housing Admin. 1938-47 & 1948-51	0.5-0.6	C	O	average η_y for income up to $10,000; H = value of owner-occupied house

TABLE 1--Continued

Researcher	Date Published	Data Source	Income Elasticity	Time Series or Cross Section Data	Renters or Owners	Comments
Friend & Kravis	1957	BLS: Wharton Survey of Consumer Expenditures, Savings and Incomes, 1950	0.65-0.86	C	R,O	12,500 observations of urban families of 3 & 4 persons whose head was aged 35-54; also tests permanent income hypothesis
Snyder	1958	published and unpublished surveys from 200 cities, 1888-1950	0.5	T	N.A.	grouped data, H excludes utilities; P = price index; $H = kY^{n}p^{b}$
Maisel & Winnick	1960	BLS: Wharton Survey of Consumer Expenditures, Savings and Incomes, 1950	0.557 (R) 0.624 (O)	C	R,O	grouped average observations; log - log specification; use of their permanent income measure made no difference; H = housing + utilities; Y = after-tax income
Muth	1960	1915-1941 macro data	0.80-1.68	T	O	H = house value for single-family income
Muth	1960	1950 city averages	1.68	C	O	H = housing stock; Y = disposable units
Reid	1962	1950 Census of Housing, 1933 Housing Survey	1.0-1.6 (R) 1.0-1.5 (O)	C	R,O	interplace estimates for 9 U.S. areas and 30 metropolitan areas where CPI is collected; 9 metro. areas where National Housing Inventory was collected; H = contract rent; Y = permanent income;

TABLE 1--Continued

Researcher	Date Published	Data Source	Income Elasticity	Time Series or Cross Section Data	Renters or Owners	Comments
						H = 10% of market value; grouped data
Reid	1962	1950 Census of Housing, 1933 Housing Survey	0.95-1.16 (R) 1.25-2.05 (O)	C	R,O	data grouped by instrumental variables; intraplace estimates
Lee	1963	1958 Survey of Consumer Finances, Survey Research Center, U. of Michigan, Board of Governors, Federal Reserve System	0.89	C	O	single equation OLS model; 117 house-buying families; movers-out not followed
Lee	1964	1920-1941	0.336-0.978	T	O	η_y = average of flow demand model and house value model
Bedrosian	1966	1960 Census of Housing, 1960 Survey of Consumer Expenditures and Income	(inter-city) 0.617 (R) 1.148 (O) (intra-city) 0.589-0.985 (R) 0.824-1.68 (O)	C	R,O	individual observations and grouped data; H = owner's estimate of market value for Census observations; H = total cost of housing ownership and operation
Lee	1968	S.R.C., U. of Mich., Survey of Consumer Finances, 1960-62	0.65 (R) 0.8 (O)	C	R,O	687 observations from 4-year panel study; Reid's definitions of H and Y

TABLE 1--Continued

Researcher	Date Published	Data Source	Income Elasticity	Time Series or Cross Section Data	Renters or Owners	Comments
Winger	1968	1962-64 FHA SMSA averages	0.76-1.18	C	O	log - log specifications; η_y higher for used homes than new
Houthakker & Taylor	1970	U.S. Dept. of Commerce; private consumption expenditure published in Survey of Current Business, 1929-70	1.5 (R) 2.4 (O)	T	R,O	H = per capita personal consumption expenditures; Y = total consumption
Houthakker & Taylor	1970	1960-61 Survey of Consumer Expenditures, BLS published in 1966	0.43 (R) 1.49 (O)	C	R,O	H = per capita personal consumption expenditures; Y = total consumption
de Leeuw	1971	Reviews work of 4 people	0.8-1.0 (R) 0.7-1.5 (O)	C	R,O	Y = normal income; H = housing expenditure per unit of time; he standardizes η_y's of Reid, Muth, Lee and Winger
Carliner	1973	S.R.C., U. of Mich. Panel Study of Income Dynamics 1968-71 data	0.41-0.75	T	R,O	Y = family income before taxes; several measures of income used; η_y higher for permanent income measures; 4500 observations

type, and note is made of the unique features of each in the Comments column.

Although many studies of housing demand have been published over the years, most of them have not been concerned with estimating the price elasticity of demand for housing. The majority of these studies (sixteen of twenty-two in Table 1) were carried out using cross-section data which simply does not lend itself to precise estimates of price elasticity. Price differences must be measured between a standardized unit of housing and the fact that houses are located in physically different surroundings means that a standardized unit of housing is difficult to find. Not only is there intracity variation in quality (such as between the central city and suburb) but there is also intercity variation. Accurate price data would be needed both within and between cities on a standardized unit of housing. These data are not readily available on a cross-section basis. Within an area price variation is not likely to be great enough that price elasticity can be accurately gauged and between areas quality differences make price comparisons difficult. For this reason almost every cross-section estimate of price elasticity has been presented with an apology for its suspected unreliability. Most studies have been focused upon the income-housing relationship as expressed by the income elasticity of demand (η_y).

Conventional Housing: Time Series Data

The first widely read work which attempted to estimate the income elasticity of demand for housing from time-series data was published by Louis Winnick in 1955. His conclusion, based on residential construction expenditures compared to either gross national product or gross capital formation from 1890 to 1950, is that consumers' preferences have shifted away from housing over this time period. He transforms aggregate data into a per-capita value for the United States housing stock (taking into account depreciation) as well as a per-dwelling unit value. His conclusion is then drawn from the fact that these measures jump up and down slightly over the sixty years' period without demonstrating any significant upward trend. In fact, per-dwelling unit value falls over time. The income elasticity of demand for housing which he derives en route to his primary conclusion is 0.5.

Guttentag responded to Winnick's conclusion by questioning the premises upon which it was derived. He specifically suggested that carrying costs are more appropriately considered than capital outlays when one wishes to look at consumer behavior. He additionally asserted that the demand for housing may not be more elastic with respect to income than with respect to price--a relationship assumed by Winnick. Winnick's "Reply" (1956) to Guttentag is coined in terms of space rent and reasserts the original

conclusion. While the issue of the place of housing in consumers' budgets may not be settled, it must be remembered that Winnick was using a "back-door" approach by using aggregate capital value if what he was really interested in is income-housing expenditure relationships. Additionally, his measure of income was observed (constant-dollars) value. So while his conclusion should not be accepted without these caveat's, it is not without empirical foundation. In fact it is consistent with Winger's (1969, p. 417) conclusion that "the actual amount of space acquired [is] relatively invariant with respect to income. . . . After the space requirements are met, apparently another set of standards comes into view" for some families. These other standards pertain to location and quality of the structure.

Probably the most respected and most widely referred to work in the area of housing is that done by Richard Muth. In particular his "The Demand for Non-Farm Housing" (1960) has received much attention. The study is now becoming dated (his time-series data end in 1941), but his methodology established the tone of much subsequent work. In estimating the stock-demand elasticities for housing, Muth uses aggregate data from the 1915 to 1941 non-war years which, of course, includes the Great Depression years. His first stock-demand equation takes the form:

$$h_t = Ap + By_p + Cr$$

where h_f = end-of-year per-capita non-farm housing stock

p = Boeckh index of residential construction costs (brick)

y_p = Friedman's per-capita expected-income series

r = Durand's basic yield of ten-year corporate bonds

This equation is the one estimated when Muth assumes rapid market adjustment to changing prices and incomes. When slower adjustment (requiring more than a year) is assumed, the model is re-specified:

$$h'_g = Ap + By_p + Cr + Dh$$

where h = beginning-of-year per-capita housing stock

The complete adjustment model yields an income elasticity of 0.55 and the incomplete adjustment model yields 0.88 for desired stock and a whopping 5.38 for new construction. In contrast to the previous estimates of other researchers for the income elasticity of housing, Muth (1960, p. 72) asserts: "The evidence gathered here suggests that both [price and income elasticity] are at least equal to about unity and may even be numerically larger."

Muth's conclusion seems to have been borne out by subsequent work, but his approach has been criticized on several grounds. The first of these criticisms deals with his assumptions. In the derivation of a "unit of housing

service," Muth equates this concept to the quantity of service yielded by one unit of housing stock per time unit. He then standardizes price in terms of payment for this unit of service. In effect this procedure says that any one unit of housing service (regardless of the type of structure producing it) is interchangeable with any other unit of housing service. Hence, under this system of measurement, distinction between housing services provided by owned homes and those provided by rental units cannot be made.

In addition to this problem Ohls (1971, p. 23) has taken issue with the assumption of constant annual depreciation which Muth employs. Ohls tests the plausibility of this assumption with data found within the body of Muth's work and finds it to be an unfounded one.

Muth additionally can be questioned on the following issues: (1) his choice of the Boeckh Construction Index as his price variable may cause problems. This Index is unable to take into account changes in productivity or possibilities for input substitution. (2) As with Winnick, capital values may be a less desirable measure for housing preferences than some measure of carrying costs. Operating costs directly attributable to housing are thus overlooked. (3) No account, other than per-capita transformation, is taken of any demographic variation.

Tong Hun Lee has also done work of note with time-series data. His conclusions, however, are at odds with Muth's. "The main findings of this study are that the income elasticity is substantially less than unity while the price elasticity exceeds unity" (Lee, 1964, p. 83). Lee's data, being largely that used by Muth, covers the period from 1920 to 1941. Lee's work extends that of Muth, however, in the area of including more appropriate credit term variables than the long-term bond yield used by Muth. He then uses single-equation least-squares regression estimation to derive values for price and income elasticities. For the elasticities he calculates two values--one using gross housing construction as the dependent variable and the other which uses price or income as dependent. Lee (1964, p. 85) then states, "the true elasticity of price (or income) should be bracketed between these two limits." This bracketing technique is statistically acceptable, but Lee's bracketing is nothing more than an arithmetic mean so that his elasticities are, in the end, averages. His 0.652 income elasticity is therefore an average of 0.336 and 0.978. Both the upper and lower limits are less than unity, however. This elasticity is derived using observed income, but Lee also tests the permanent-income concept. The upper and lower limits then become 1.283 and 0.335 with an average of 0.809. The mean is still less than unity,

but the interval includes areas on both sides of unity. Lee (1964, p. 88) concludes:

> . . . our tentative conclusion is that the income elasticity of the desired demand for housing stock is smaller than one, while its price elasticity is more negative than minus one. The permanent income hypothesis holds in the area of housing demand, in the sense that the response of housing demand appears greater to permanent income changes, but the elasticity of permanent income appears to be less than unity.

The final time-series study to be considered here is that done by Geoffrey Carliner in 1973. His work is of particular interest because he derives income elasticities from regression equations specified both with and without demographic terms. Results from these regressions show that elasticities are higher for owners than for renters and that elasticities are consistently higher when demographic variables (for age, race, and sex) are included in the model. Carliner performs his calculations using several measures of income, ranging from one-year observations to a permanent concept incorporating imputed rental value for house owners. Numerically, his income elasticities range from 0.410 to 0.746, being highest when income is expressed in a permanent form. Carliner's (1973, p. 531) summary statement expresses a belief that "the elasticity of housing demand is around 0.6 to 0.7 for owners and 0.5 for renters." He thus ends up in the same neighborhood as Lee.

Conventional Housing: Cross-Section Data

An early example of a cross-sectional study of housing which derives an income elasticity was published by Ogburn in 1919. He used 200 family budgets from Washington, D.C., and derived an elasticity of 0.93 for renters. Subsequent work by other writers produced elasticities varying from 0.15 (Duesenberry and Kistin, 1953) to 0.86 (Friend and Kravis, 1957) between 1916 and 1960.

In 1962 Margaret Reid published her Housing and Income study. She openly challenged the validity of the Schwabe Law of Rent which had been sleeping peacefully for almost a century. She asserted, and even had empirical evidence to verify, that the income elasticity of demand for housing is greater than unity by a substantial amount--being as high as 2.05.

Dr. Reid's conclusions and work are based upon a permanent concept of income. She maintains that such a measure of income is the only appropriate one since the time horizon involved in housing-consumption decisions is quite long and since observed annual income figures are subject to much fluctuation and are at the mercy of random, exogenous influences. Using grouped data from several sources (spanning three decades), she demonstrates that the income elasticity of demand for housing is greater than unity between and within cities.

As might be expected, this work has received quite a bit of attention in the housing literature. In fact, a Ph.D. dissertation written by Sarah Bedrosian (1966) addresses itself to the findings and methodology involved. The primary criticism of Reid's work in this dissertation is that "the coefficients are to a great extent a product of the phenomenon of data combination, and not necessarily a reflection of the true income elasticity of housing demand" (Bedrosian, 1966, p. 341). Bedrosian comes to this conclusion on the basis of Reid's having grouped household observations by the use of instrumental variables such as geographic area. Besides this criticism relating to statistical methodology, Bedrosian takes issue with the theoretical assumptions and the data base used by Reid.

Lee has also taken issue with Reid, primarily on the basis of her method of analysis. He says, ". . . Reid's averaging process tends to 'wash out' many relevant differences in permanent housing components that should be explained by variables other than permanent income. Reid classified individual household observations into groups according to census tracts and housing-quality categories within places, and geographical areas such as cities. For each group she computed averages of measured incomes and of housing data" (Lee, 1968, pp. 487-88). Additionally, her model specification implies that nothing, other than

income variation, has any influence on housing expenditure. Hence, in Lee's estimation, Margaret Reid overstates the true income elasticity for housing. He calculates it to be about 0.8 for owners and 0.65 for renters. It should be noted, however, that Lee's data consisted of a four-year reinterview survey in which some of the original respondents moved and were not reinterviewed. His results are, therefore, biased to this extent.

Frank de Leeuw has summarized and compared cross-section work by four people (Reid and Lee included) in his 1971 article. His final thoughts indicate an elasticity of 0.8 to 1.0 for renters and 0.7 to 1.5 for owners. While his is not the final word on the subject, he has attempted to reconcile existing differences between four widely-read studies. In addition to the work done by Reid and Lee, de Leeuw examines that done by Muth (mentioned earlier in this work) and also a study published by Winger (1968). De Leeuw cites certain shortcomings in each of these works and suggests how each noted "deficiency" would bias the results that each of these four people has published. His belief is that the original range of income elasticity reported by these four researchers--0.6 to 2.1--is actually, when corrected for the shortcomings he notes, narrowed considerably. Numerically, he adjusts the other researchers' results and narrows the range for income elasticity to

0.81 to 0.99 for renter-occupied households and to about 1.1 for owners.

Mobile-Home Housing

Economic literature dealing specifically with mobile homes is almost nonexistent. This is probably a result of several factors. First, mobile homes were used for permanent housing only rarely before 1955. This is the year that ten-foot-wide units were first produced. Use of mobile homes as permanent housing expanded quickly thereafter. A second reason why mobile homes have received so little attention in the professional literature is that, nationally, they make up such a small fraction of the total housing stock (roughly three percent). The growth of this form of housing is, however, undeniable. Mobile-home production accounted for almost 22 percent of all housing units constructed in 1970. Table 2 shows the growth in production of mobile homes since 1947.

Robert French and Jeffrey Hadden published an article in *Land Economics* in 1965 which analyzes the characteristics of mobile homes at a national level. Their analysis does little more than paint a picture of the typical mobile-home dweller and his unit in 1960. They conclude that "trailers" are an urban phenomenon, a "new kind of suburbia," if you would. They are utilized most

TABLE 2
Mobile-Home Shipments and Sales, 1947-1973

Year	Manufacturers' Shipments to Dealers in U.S.	Retail Sales (Estinated)
1973	566,920	$4,046,382,000
1972	575,940	4,002,783,000
1971	496,570	3,297,225,000
1970	401,190	2,451,271,000
1969	412,690	2,496,775,000
1968	317,950	1,907,700,000
1967	240,360	1,370,052,000
1966	217,300	1,238,610,000
1965	216,470	1,212,232,000
1964	191,320	1,071,392,000
1963	150,840	862,064,000
1962	118,000	661,000,000
1961	90,200	505,000,000
1960	103,700	518,000,000
1959	120,500	602,000,000
1958	102,000	510,000,000
1957	119,300	596,000,000
1956	124,330	622,000,000
1955	111,900	462,000,000
1954	76,000	325,000,000
1953	76,900	322,000,000
1952	83,000	320,000,000
1951	67,300	248,000,000
1950	63,100	216,000,000
1949	46,200	122,000,000
1948	85,500	204,000,000
1947	60,000	146,000,000

Prior to 1947, production varied from 1,300 in 1930 upward to 60,000 in 1947.

10-wide homes came into mass production in 1955.
12-wide homes came into mass production in 1962.
14-wide homes came into mass production in 1969.

SOURCE: Flash Facts, Mobile Home Manufacturers Assocation, June 1974.

heavily in areas of rapid population increases and in areas of low population density. There are generally fewer persons per room in mobile homes than in conventional permanent houses, but the rooms are also smaller. Contrary to conventional wisdom, mobile homes are not "substandard" housing when gauged by either overcrowding or physical condition of the structure.

In terms of the ages of the people who live in mobile homes, they were found to be either young (couples usually) or old (retired). French and Hadden (1965, p. 138) suggest "that the largest group of trailer dwellers are young lower middle-class working families who are looking for a better way of life but cannot yet afford to buy a permanent home in the suburbs." They concluded, as most writers do, by pointing out the need for further research in the area.

Robert Berney and Arlyn Larson, following French and Hadden's lead, published an empirical piece of research a year and a half later (1966). Working with a survey of 800 Arizona mobile-home households, they used basically the same approach as that of French and Hadden. Data were collected for each household on eleven different variables, among which were: value of unit, family income, family assets, and taxes paid on unit. (The variables were selected and the study performed with an eye to implications for

tax policy.) Their work revealed that, in Arizona, the occupational and income distributions are almost identical for the state's mobile-home households and all of its households. Retired households were found to have lower incomes and fewer assets than working households. However, neither price nor income elasticities were calculated for their study.

The U.S. Department of Housing and Urban Development published a volume entitled Housing Surveys in 1968. Part 2 of this volume dealt exclusively with mobile homes. Data collected in 1966 revealed that the overall picture of mobile homes and their residents was much the same as that depicted in the two above-mentioned articles. Among other things, this study found the cost of a mobile home to be roughly three-tenths that of a multiple-family structure (per unit). It also found that the median household income for a mobile-home family was only about 85 percent of the median household income for the entire national population. As far as the mobile home itself is concerned, the unit was probably financed for seven years and the downpayment was less than $1,000. Typically the residing family was composed of husband, wife, and a young child. The adults were generally less-educated than the general population. The unit itself was less than half the size of the average housing unit being sold and was located outside of a Standard Metropolitan Statistical Area.

Some attitudinal questions were included in the survey form, but other than averages, almost no statistical tests were performed with any of the data collected. No effort was made to ascertain what factors were of importance in affecting demand and no elasticities were calculated.

Two books which take an encyclopedic approach to mobile-home housing have been published in the 1970s. Margaret Drury (1972) looks at what she calls an "unrecognized revolution" in American housing. After an introduction which deals with mobile homes from an historical perspective, she includes a chapter which is basically a review of mobile-home literature. She covers studies in trade-type publications such as the Mobile Home Journal and Mobile Life Magazine. As in previously mentioned sources, the statistical approach involved hardly goes beyond averages and percentages. We are shown a "profile" of the mobile home resident of the 1960s. Her approach deals with social changes leading to development and expanded use of mobile homes as well as the institutional resistance to this "new" form of housing. All in all, Ms. Drury's book is a quick trip through the (non-technical) mobile-home literature from a sociological point of view.*

*A new edition of this book was published in 1976.

The other book to be considered here is Housing Demand: Mobile, Modular, or Conventional by Harold A. Davidson (1973). This work is quite similar to that of Ms. Drury, but does carry analysis a bit further. For example, Davidson looks at mobile homes in relation to other housing alternatives and attempts to discover the determinants of the demand for mobile homes. It is this section of the book which will be considered here.

Davidson divides his variables influencing demand into three groups. The first group is made up of economic variables. It includes the income distribution of the U.S. population, the selling price of the mobile home, financing terms, and property tax saving. The second group of variables are demographic and social in nature. Included are age distribution, valuation of leisure time, and impact of changing social values. His final group of variables is called "aesthetic and political." These include mobile home design changes and mobile home park development.

Using multiple regression analysis, Davidson derives a linear model to estimate parameters in several demand equations by the ordinary least squares technique. He estimates two demand equations for mobile homes. (These equations are estimated on the basis of quarterly data collected from a number of sources.)

$$(1)\quad MHD_t = \underset{(-5.93)}{-372.742} - \underset{(-2.27)}{137.184}MPCC_t + \underset{(3.01)}{4.303}PR_t - \underset{(-2.32)}{0.079}PDI_{t-1} + \underset{(4.46)}{0.011}THH_{t-1} + \underset{(5.07)}{26.16}D_t$$

$$d.f. = 45 \qquad R^2 = .965 \qquad \sigma = 6.073$$

$$(2)\quad MHD_t = \underset{(-1.46)}{-55.110} - \underset{(-3.51)}{24.661}VR_{t-1} - \underset{(-2.67)}{62.106}STHS_{t-1} + \underset{(9.81)}{0.29}MFI_{t-1} + \underset{(6.41)}{26.524}D_t$$

$$d.f. = 46 \qquad R^2 = .954 \qquad \sigma = 6.99$$

where MHD_t = demand for mobile homes, expressed as total mobile home shipments

$MPCC_t$ = a price variable, the average selling price of a mobile home

PR_t = prime interest rate

PDI_{t-1} = per capita disposable income

THH_{t-1} = total number of households

D_t = dummy; D = 0 all quarters before 1971 1; D = 1 for 1971 I and later

VR_{t-1} = vacancy rate (expressed as a percentage)

$STHS_{t-1}$ = $\frac{\text{single-family housing starts}}{\text{total conventional housing starts}}$

MFI_{t-1} = median family income

(Subscripts indicate whether observation is for same time period or is lagged one quarter.)

The numbers in parentheses are t values. Equation (1) has an R^2 of .965 and Equation (2), .954. All coefficients are

significant at the 5 percent level. Neither of these equations includes a variable representing either of the specific age groups observed to be the primary users of mobile homes. It would appear that such an omission is serious. Davidson's explanation for this omission centers around the fact that inclusion of a variable he labels ASP (which is defined as the absolute number of people in the 20 to 29 and 65 to 74 age ranges) causes the other variables to become insignificant. He attributes this problem to either multicollinearity or high correlation with the dependent variable. It seems that a respecification of age-specific variables would be preferable to ignoring the factor altogether.

An elasticity of mobile home demand for personal disposable income is calculated at -1.688. This indicates that an increase of one percent in personal disposable income will cause mobile-home demand to decrease by 1.688 percent. Such a finding would define mobile homes as an inferior good. While this conclusion may not seem unreasonable, the income variable is an observed one, not a permanent measure of income. At any rate, a finding such as Davidson's certainly calls for further exploration into the income elasticity for mobile home demand. This is one particular aim of this piece of research.

Summary

While the studies just discussed are not exhaustive of all the research that has been done on housing demand, they do include the most significant work done in the area. Standard techniques for adapting statistical procedures and model building to housing data have evolved. Multiple regression seems to be the most widely used statistical tool and it is, indeed, a powerful one. Using this procedure, the researchers discussed above have estimated income elasticity of demand for housing. The range of estimates is wide, from 0.15 to 2.05. This variance might leave one bewildered as to just what the income elasticity is for housing, but to some extent this variation is a function of the data used and methodological differences. Perhaps, as de Leeuw told us, there is more agreement than appears on the surface. But these studies in the academic literature are concerned only with conventional housing. Application of the statistical techniques developed in the housing demand literature has not been made to the mobile-home sector except in Davidson's work. The fact that he took no account of the age of the occupant, and that the income elasticity of demand he found was negative leaves several questions unanswered, even after this attempt to analyze the mobile-home market.

CHAPTER III
THE DEMAND FOR MOBILE HOMES

Household budgetary patterns have been of interest to economists for some time. How families and individuals operate within their budget constraint is, in fact, one of the primary issues dealt with by microeconomic theory. As one might expect a priori, expenditures for housing constitute a large portion of total expenditures, both at the micro and macro levels. Outlays for housing, as with some other expenditures, have both consumption and investment aspects. While one is consuming the housing services rendered by a structure, the structure itself may be appreciating over time. Because of such conditions, one writer (Smith, 1958, p. 1) has even suggested that housing is not a suitable topic for theoretical analysis:

> . . . housing involves major non-economic complexities, mainly legal, institutional, and aesthetic; housing is an inconvenient hybrid, a consumer's durable good, which means that the economists cannot be sure whether it belongs under the heading of utility maximization or savings and investment.

While there is some truth at the heart of these remarks, most economists would agree that any economic good is deserving of theoretical analysis. And an area as prominent

as that of housing attracts considerable attention, both theoretical and otherwise.

Housing consumption studies have traditionally looked at housing as strictly a consumption matter, ignoring resale value, which might be greater than the original purchase price. So, whereas conventional housing may appreciate over time--due primarily to inflation and a rising site value--such is not the case with a mobile home. They depreciate over time much like an automobile and the industry even has several publications for estimating the current market value of a mobile home--just as car dealers have their own industry guides.

Because of the mobile nature of a mobile home, it is an easy matter to separate the value of the structure from site value of the land upon which it may be located. A mobile home owner has the option of locating his unit (whether it is valued at $4,000 or $14,000) on a small or a large parcel of land, close in to the city (wherever zoning permits) or on a large, rural parcel. Given this possibility, it is easy to separate the demand for mobile-home housing services from the demand for neighborhood quality, however estimated.

Given this dichotomized process whereby the housing choice and the location choice are made separately, the value of the housing unit itself is easily separable. Fur-

thermore, in looking at the economics of this housing choice, it seems obvious that it is appropriate to consider the choice strictly as a consumption matter. Who would make an investment decision knowing in advance that the item invested in would depreciate? Only potential tax benefits could explain such a decision, and the taxation of mobile homes in Florida is handled just as that for an automobile, so this factor is not likely to be relevant for mobile-home purchasing. For these reasons it seems appropriate to consider the purchase of a mobile home as a case of purchasing a consumer durable good.

When a household (family or single person) enters the housing market or makes a change within it, there are several categorical decisions to be made. These may be made independently or jointly, and the order in which they are made will vary from case to case.

Probably the most effective constraint in the majority of housing decisions is budgetary in nature. This is simply a variant on one of the major building blocks of economics--the clash between unlimited wants and limited resources. In this case many people might wish to live in a mansion but have incomes sufficient for only a modest living environment. So if income is an effective constraint for most households, the other decisions will be made following a decision about maximum affordable housing

expenditures. Only if this figure is sufficiently large can conventional home ownership be a viable alternative. So tenure choice (own or rent) is also a decision for some households. If rental housing is chosen, one may rent a conventional single-family structure, a unit in a multi-family structure, or a mobile home. Similar alternatives exist in the owner-occupied sector also. This study focuses on households in Florida which have made decisions to own or rent a mobile home.

The cost of housing in the United States has climbed over the years to the point where talking about low-cost new housing is much like talking about the unicorn--if it ever existed, it is now only a memory. Rising costs have prevented many families from being able to consider home ownership.* If there is any low-cost housing still being produced, it is probably a mobile home. Several facts operate to make this statement defensible: (1) The average cost per square foot of a conventional house was $14.65 in 1971. The comparable figure for a mobile home was $9.07 (Davidson, 1973, p. 119). (2) Mobile homes typically have fewer square feet than conventional houses. (3) Since mobile homes can be and are often located

*For a partial explanation of this phenomenon, see Anthony Downs, Urban Problems and Prospects (Chicago, 1976), pp. 77-85.

on small parcels of land (owned or rented) payment for site value can be kept low. These factors combine to make mobile-home housing relatively inexpensive as a housing alternative. The only competition in terms of low monthly expenditure would come from rental of old conventional multi-unit structures. The market value for such units could have fallen over time, due to physical deterioration and/or undesirable location.

Florida's climate also lends itself to this particular type of housing, and fewer square feet to heat or cool, even if construction quality is below conventional housing, means lower utility bills. Taxes on mobile homes are paid through annual license plate purchases and remain at low levels. If one decides he is tired of his present unit, transaction costs are low and new furniture and appliances are normally included in a new unit.

In addition to these factors, there is another force operating on the demand side which is especially pertinent in Florida. Many people, retirees in particular, are not buying a mobile home just to get another house, but to achieve a whole new living environment and life style. A plush "adult mobile-home community" is not difficult to find, especially in south Florida. While retaining some of the benefits of home ownership, it is also possible to enjoy some of the benefits of living in a rental complex.

In summary, there are a number of factors which make mobile-home housing a desirable alternative in Florida. Among them are low price, low maintenance, single-family ownership, flexibility in choice of environment (mobility), a relatively well developed used mobile home market, and the favorable climate. While some do, not all mobile-home residents are living in their units because they cannot afford anything else. This fact, while not obvious from one year's observed income, is more readily observable when a permanent measure of income is considered.

Descriptive Overview--Florida and United States

Before getting into actual mobile home usage within the state, some observations comparing Florida and the United States as a whole will be of interest. Some crucial comparisons are highlighted in Tables 3 and 4. Table 3 focuses on an overall comparison of the United States and Florida for certain selected demographic characteristics. Florida had about 3.34 percent of the nation's population in 1970 and 3.68 percent of the nation's year-round housing units. As a percentage of this housing stock, however, mobile home usage in Florida is about two and a quarter times the level observed nationwide. Florida's population is somewhat older than that of the nation, as observed by the differences in median age and percentage

TABLE 3
Comparisons between the United States and Florida, 1970

	United States	Florida	Florida as a % of the U.S.
1970 population	203,211,926	6,789,443	3.34
Year-round housing units	67,656,566	2,488,968	3.68
Mobile homes as a % of year-round housing stock	2.7	6.1	225.90
Median age	28.1	32.3	115.00
% nonwhite	12.5	15.8	126.40
% of population over 65	9.9	14.6	147.50
% of people 65+ employed:			
Male	24.8	17.5	70.60
Female	10.0	7.7	77.00
Median years of school completed	12.2	12.1	99.20
Median family income (1969)	9,586	8,261	86.20

SOURCE: 1970 Census of Housing and Census of Population.

of population over sixty-five years of age. Educationally, Floridians are very slightly below the national average, perhaps due to the fact that her people are a bit older. Relatively fewer of the sixty-five-and-over population in Florida worked in 1970 than was true for the nation, supporting the idea of widespread retirement to Florida. Connected with these phenomena is the fact that Florida's 1969 median family income was about 14 percent below the national figure.

Table 4 focuses on only families living in mobile homes in 1970. Among these people, 8.27 percent of the nation's mobile-home households were found in Florida. (Remember, Florida had only 3.34 percent of total population.) Slightly more of Florida's mobile-home households contained only one person and considerably more were headed by persons over sixty-five. Relatively fewer household heads worked in Florida than in the United States, and of the heads who were employed, a lesser percentage of Floridians living in mobile homes held "blue-collar" jobs. Income-wise, Florida's mobile home residents received substantially less than their national counterparts. Finally, Florida mobile-home residents are found to be, in fact, quite mobile.

In summary, there is a heavy usage of mobile homes in Florida. Some of the generalities about the nation's mobile-home dwellers are also true in Florida. Their in-

TABLE 4
Characteristics of Mobile Home Households for the United States and Florida, 1970

	United States		Florida	
	Owner-occupied	Renter-occupied	Owner-occupied	Renter-occupied
Mobile-home households	1,752,577	321,417	147,970	23,499
One-person households (% of total mobile home households)	19.4	25.6	23.4	29.1
% of households whose head is 65+ years	18.1	12.8	39.9	21.7
Median school years completed by head	11.8	12.0	11.3	11.6
% of heads employed in 1969	70.0	64.2	46.9	55.2
% of employed heads who held "blue collar" jobs	50.0	67.6	30.9	65.2
Median 1969 family income (to nearest $100)	7,800	5,800	6,300	5,200
% of household heads living in a different state 5 years ago	13.9	26.2	26.1	37.0

SOURCE: 1970 Census of Housing and Census of Population.

comes are relatively low, and families are typically small. Especially in Florida, the mobile home is an apparently attractive housing choice for older people.

Public Use Sample

The primary data source to be used in this demand study is the Public Use Sample of Basic Records from the 1970 United States Census. This cross-sectional data base, collected on magnetic tape, is a one-in-a-hundred representative sample which combines both the Census of Population and the Census of Housing to make available records for both persons and households. Observations at the state and Standard Metropolitan Statistical Area (SMSA) level are available as well as for county groups created on the nodal-function area concept developed by the Bureau of Economic Analysis' Regional Economics Division. Figure 1 shows the (16) county groups for Florida and the four-digit numeric identifier of each.

Area 31 is northeast Florida and eight southeastern Georgia counties which are heavily influenced by the Jacksonville SMSA (subarea 3101). Subarea 3102 includes Gainesville and Ocala. Area 32 is central Florida and includes Orlando as subarea 3201. South Florida is Area 33 and is made up of eight subareas which include Tampa (3303), St. Petersburg (3304), Miami (3302), Fort Lauderdale-

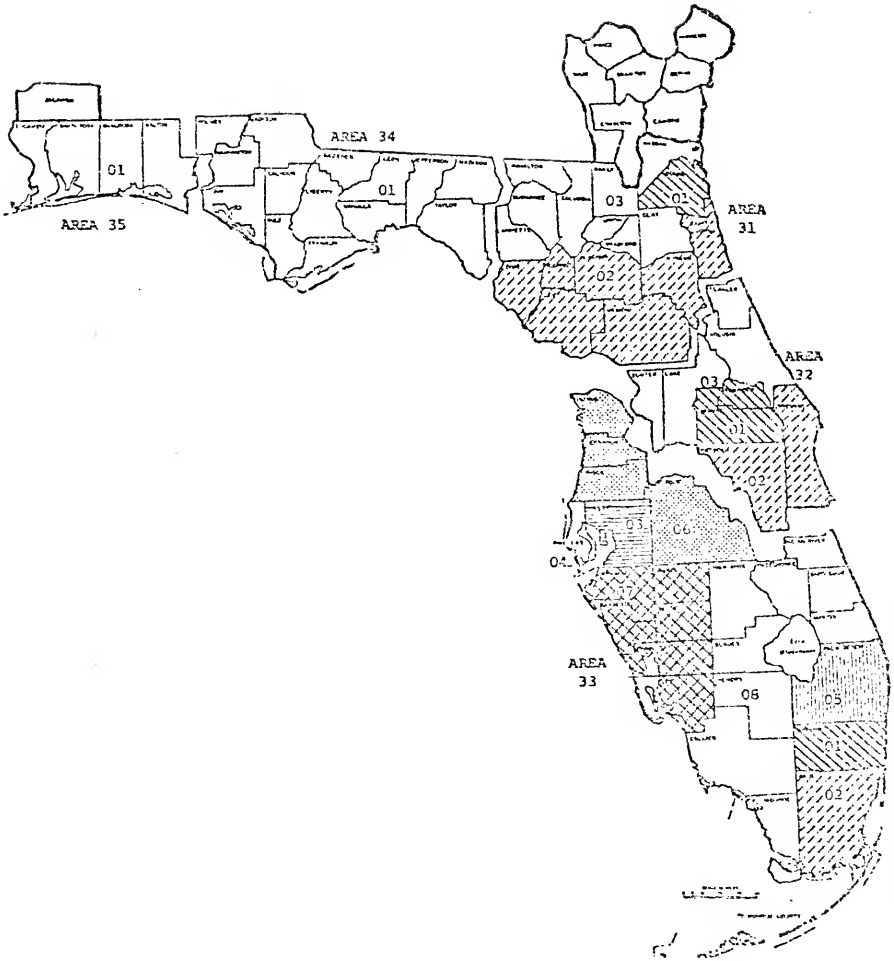

FIGURE 1
Public Use Sample Areas and
Subareas for Florida

Hollywood (3301), and West Palm Beach (3305). Area 3401 is west-central Florida and includes Tallahassee, the state's capital. Area 3501 is made up of the four western-most Florida counties and one adjoining Alabama county. Pensacola is the dominant city in this area.

There are approximately 125 variables available per observation. These variables constitute data covering persons and households. For example, there are structural characteristics about the person's dwelling unit as well as financial characteristics about the house value or rental rate. At the individual level there are characteristics and attributes, including data on age, race, sex, education, and income.

For purposes of this study, data were collected for heads of households and for wives of heads of mobile-home households. Combining the information on these person records constitutes a household record. On the one-percent sample tape there is a total of 22,189 household records for Florida. Of these, 15,456 are owner-occupied and 6,733 are renter-occupied units.

Selected characteristics for the county groups are listed in Tables 5 through 8. Data are included for heads of all owner-occupied and renter-occupied housing units and for heads of mobile-home households, both owned and rented.

TABLE 5
Selected Characteristics of Florida's Owner-Occupied Households, 1970

Area	Number of Cases	Percent White Head	Percent Male Head	Percent Lived in Same State 5 Yrs. Ago	Mean Age of Head	Mean 1969 Family Income	Mean Yrs. of School for Head	Mean Persons per Household
3101	1,091	82.9	80.4	85.6	48.08	10,148	10.90	3.29
3102	566	83.4	81.1	87.1	52.94	8,418	10.80	3.03
3103	526	82.5	80.8	91.3	49.80	8,725	9.79	3.24
3201	933	91.1	82.1	81.2	49.24	10,156	11.42	3.20
3202	556	94.6	86.5	72.7	46.20	11,364	12.42	3.38
3203	696	91.2	77.6	78.9	57.63	7,557	10.68	2.67
3301	1,417	93.4	82.7	72.3	53.30	10,510	11.09	2.99
3302	2,191	91.1	81.8	86.1	50.77	11,994	11.44	3.28
3303	1,158	92.1	80.4	83.1	49.95	9,295	10.66	3.10
3304	1,540	96.0	77.0	74.6	59.40	8,426	11.12	2.54
3305	748	92.0	81.1	78.7	54.13	11,147	11.44	2.94
3306	891	92.6	81.5	77.4	56.13	7,231	10.37	2.78
3307	1,109	95.7	79.7	72.2	59.21	8,273	11.11	2.52
3308	580	91.7	82.1	76.6	54.96	7,985	10.77	2.88
3401	686	80.2	80.6	89.4	49.89	8,571	10.17	3.18
3501	768	88.2	81.4	84.1	47.91	9,193	10.73	3.33

SOURCE: 1970 Census of Population and 1970 Census of Housing as combined in the Public Use Sample.

TABLE 6
Selected Characteristics of Florida's Owner-Occupied Mobile Homes, 1970

Area	Number of Cases	Percent White Head	Percent Male Head	Percent Lived in Same State 5 Yrs. Ago	Mean Age of Head	Mean 1969 Family Income	Mean Yrs. of School for Head	Mean Persons per Household
3101	58	94.8	81.0	65.5	39.85	6,778	10.40	2.81
3102	70	98.6	91.4	71.4	47.91	6,223	10.33	2.94
3103	51	92.2	84.3	84.3	37.53	6,992	9.96	3.16
3201	78	100.0	87.2	70.5	47.12	6,842	10.92	2.76
3202	75	97.3	81.3	62.7	48.17	7,179	11.24	2.51
3203	89	98.9	77.5	59.6	53.29	5,958	10.62	2.16
3301	80	100.0	80.0	53.7	57.51	7,906	10.68	2.05
3302	80	98.7	78.7	73.7	53.74	6,456	10.25	2.39
3303	89	93.9	82.0	66.3	47.90	6,749	10.14	2.45
3304	205	100.0	74.1	60.5	65.98	5,537	10.41	1.86
3305	63	96.8	74.6	71.4	54.13	6,898	10.76	2.24
3306	140	99.3	85.0	67.1	58.08	4,996	9.74	2.23
3307	211	100.0	78.7	61.1	64.57	5,322	10.66	1.87
3308	99	99.0	88.9	61.6	53.91	5,559	10.34	2.49
3401	74	93.2	89.2	70.3	36.01	5,909	11.38	2.60
3501	76	94.7	92.1	61.8	36.43	7,061	11.05	3.20

SOURCE: 1970 Census of Population and 1970 Census of Housing as combined in the Public Use Sample.

TABLE 7
Selected Characteristics of Florida's Renter-Occupied Households, 1970

Area	Number of Cases	Percent White Head	Percent Male Head	Percent Lived in Same State 5 Yrs. Ago	Mean Age of Head	Mean 1969 Family Income	Mean Yrs. of School for Head	Mean Persons per Household
3101 3102 3103	912	72.3	67.8	70.1	40.69	5,883	11.13	2.89
3201 3202 3203	779	79.8	70.1	61.4	43.99	6,859	11.26	2.72
3301 3302 3303 3304 3305 3306 3307 3308	4,494	81.1	69.9	59.9	47.66	6,924	10.64	2.55
3401	257	71.2	74.3	70.4	39.35	5,585	11.34	2.93
3501	291	79.4	77.0	48.8	36.51	6,081	11.07	3.03

SOURCE: 1970 Census of Population and 1970 Census of Housing as combined in the Public Use Sample.

TABLE 8

Selected Characteristics of Florida's Renter-Occupied Mobile Homes, 1970

Area	Number of Cases	Percent White Head	Percent Male Head	Percent Lived in Same State 5 Yrs. Ago	Mean Age of Head	Mean 1969 Family Income	Mean Yrs. of School for Head	Mean Persons per Household
3101 3102 3103	35	97.1	85.7	51.4	33.11	4,346	10.97	2.94
3201 3202 3203	18	94.4	77.8	22.2	36.50	5,178	10.11	2.56
3301 3302 3303 3304 3305 3306 3307 3308	101	100.0	69.3	51.5	48.98	4,212	10.19	2.05
3401	13	100.0	76.9	53.8	25.92	4,692	13.39	2.85
3501	20	100.0	85.0	5.0	25.90	4,055	12.30	2.30

SOURCE: 1970 Census of Population and 1970 Census of Housing as combined in the Public Use Sample.

For owner-occupied housing, mobile homes constitute between 3.65 percent of the housing stock (in area 3302) and 19.03 percent (in area 3307). In half of the sixteen areas, mobile homes account for more than 10 percent of the owner-occupied housing stock. In every one of the county groups, the percentage of mobile home owners is more predominately white than the racial composition for all Florida home owners. This is observed in spite of the fact that overall, white incomes are above non-white incomes and mobile homes are relatively low-cost housing. It is possible that zoning restrictions on location of mobile homes may be important in explaining why nonwhite families do not choose to live in mobile homes.

Also without exception in each area, mobile home families have lower average incomes than do other families owning their own homes. In subarea 3102 mobile home owners' mean incomes were about 80 percent of those for all home owners but in subarea 3302 they were not much over 50 percent of the area all-home owners figure. In all but three of the county groups this disparity in incomes parallels educational differences. In these three regions (3103, 3401, 3501) the mobile-home families are younger than the all-owners families. In the "retirement center" areas (3304, 3307) the mobile-home owners are significantly older than are all owners. And in all areas, the mobile-home owners are, indeed, more mobile--a lesser percentage

having lived in the state five years before the census in every case.

Only 11 percent of Florida's mobile-home housing stock is renter-occupied. In the case of a rented unit it is not uncommon to find that the owner has previously lived in the mobile home and has moved into conventional housing. Renters, therefore, usually do not reside in newer units. Demographically, the renters of mobile homes are in some respects like other renters and in other respects like mobile-home owners. They are generally highly mobile and (except for south Florida) quite young. They are also largely white-headed families with below-average educational attainment (except for western Florida). Their family incomes are below other renters', below mobile home owners', and considerably below all owners' incomes. Because of the small number of households involved, renter-occupied mobile homes are not disaggregated below the five major area groups.

It appears that mobile home owners are drawn from both the potential renter and owner markets. If income is the relevant constraint for most families, however, it might be concluded that, on the basis of observed 1969 family income, mobile-home owners come primarily from the potential renter segment rather than from the potential home owners. Also in terms of mobility, age, and family

size, mobile-home owners approximate the characteristics of all renters. Mobile-home ownership is apparently closely related to the life cycle. Young couples and older people find them to be a satisfactory housing alternative, but middle-aged families do not make heavy use of them as permanent housing.

Some parts of south Florida are heavily populated by retirees. Pinellas, Manatee, Sarasota, Charlotte, and Citrus counties had 1970 populations for which one out of every four persons was sixty-five years of age or over. In fact, at the state level, Florida has a higher percentage of its population over sixty years than does any other state. In 1970, 20.7 percent of Florida's household population was over sixty while the comparable figure for the nation was 14.9 percent (Housing of Senior Citizens, p. 487). Figure 2 focuses on the age distributions of home owners at the national and state levels. When one analyzes home ownership, he can expect to find certain trends. Up to some age it might be expected that the incidence of home ownership would be increasing. Very few young people have the financial resources needed for purchasing a home. This trend is noted at the national and state levels. The greatest percentage of United States homeowners is found in the 45 to 54 cohort. After that age, ownership falls slightly, probably as a result of older

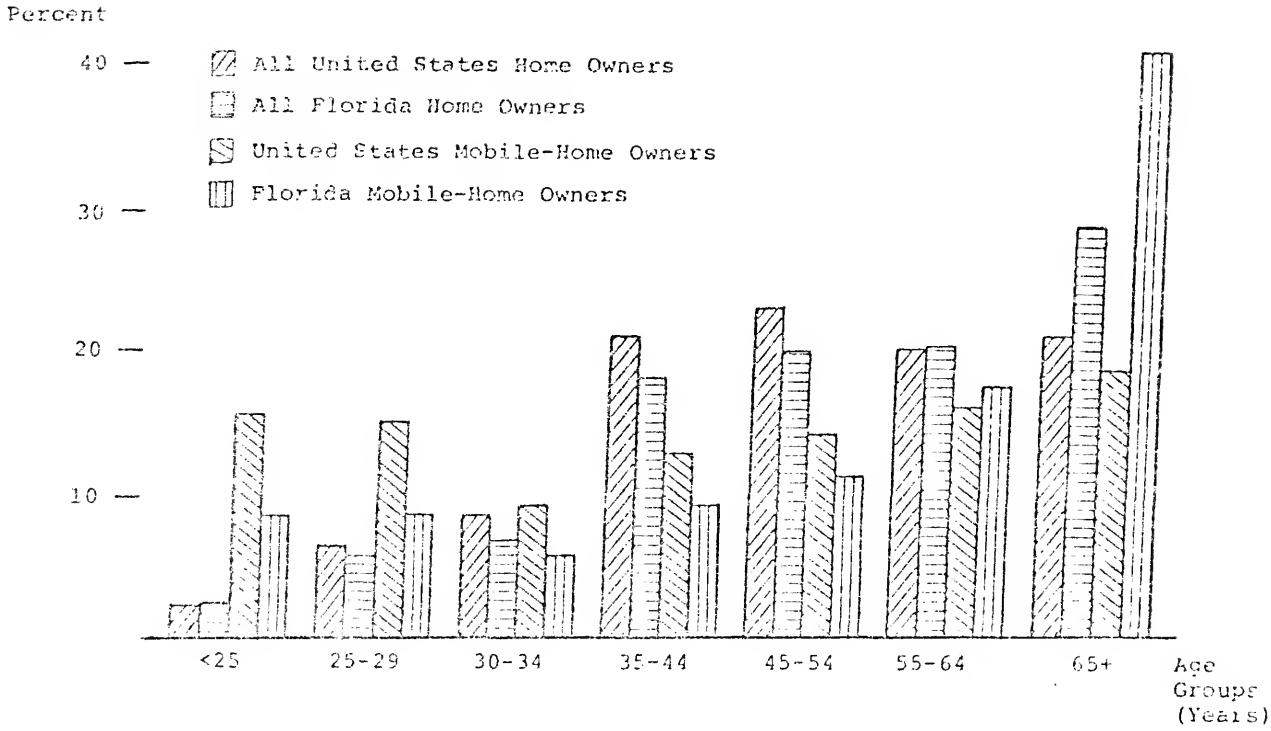

FIGURE 2
Age Group Distribution of Home Owners for the United States and Florida, 1970

SOURCE: 1970 Census of Housing.

people making housing adjustments in order to get away from the necessary maintenance and the natural decline in the size of older-age cohorts as members pass away. In Florida, however, the heavy in-migration of older people causes the incidence of ownership to increase with age all the way up the age spectrum. Almost 28 percent of Florida's home owners are at least sixty-five years old.

When ownership is restricted to mobile homes the trend is quite different. Heaviest usage of this type of housing is again by older people, but in addition to this fact, and in contrast to conventional ownership, young people constitute a significant proportion of mobile-home owners. In fact, more than 30 percent of the nation's mobile-home owners are under thirty. In the middle-age range, where conventional home ownership peaks, the incidence of mobile-home ownership is lowest. This is the pattern for the nation. For Florida the same generalizations can be noted with certain modifications. Almost 40 percent of Florida's mobile-home owners are over sixty-five! This housing choice is extremely popular among Florida's older population. Florida has more than her share of older citizens, and many of these people buy a mobile home.

CHAPTER IV
METHODOLOGY AND MODELS

As a minimum, microeconomic theory suggests that the demand for any good is a function of the good's price, the price of competing goods, the incomes of potential demanders, and existing tastes and preferences (which are usually assumed to be exogenous). Besides these "economic" factors, it is quite possible that "non-economic" factors (which may or may not be quantifiable) may be relevant in determining the level of demand. The "non-economic" variables which will be dealt with in this research are, to some extent, quantifiable, and may be classified as demographic in nature.

Before we proceed to deal with the variables considered, a note on cross-section consumer demand studies is in order. Prais and Houthakker (1955, p. 8) have dealt with the issue of cross-section versus time-series studies as follows:

> In an analysis of family-budget data designed to establish laws describing the behavior of consumers the assumption has to be made that by observing consumers in different circumstances at the same time, information may be obtained which is relevant in forecasting the behavior of any particular consumer when his circumstances change through time. To take a particular example, it may be assumed that if there are observations on

> two households enjoying different incomes and the income of the first household is next year changed to that of the second, then its expenditure pattern will tend to correspond with that of the second household as observed in the base year. In principle, the assumption made need not be so restrictive as in this example, but whenever a so-called cross-sectional study is made there must ultimately be some assumption which allows the results to be applied to changing situations. In general, it is assumed that the differences which are observed to exist are the result of the differences in circumstances acting on consumers who react in substantially the same manner.

Cross-section data is analogous to a snapshot--a picture of what exists at a point in time. It enjoys one particular advantage over time-series data--serial correlation does not have to be dealt with. Otherwise, statistical analysis of the two types of data is undifferentiated. Whereas time-series data require repetition in collection, such is not the case with cross-section data. The problems of definitional changes or method of collection changes which often are found in the use of time-series numbers are not found with cross-section data. Any observations which are not comparable with the rest of the data may be deleted without breaking the time series.

Models to Be Estimated

The point of this research is to analyze the demand for mobile homes. Total demand is the sum of demands arising from the owner and renter sides of the market.

Owners purchase their mobile homes and pay for them either upon purchase or over a period of years, normally not more than seven. Renters pay rent just as renters of conventional apartments do.

It cannot be determined from the data to be analyzed whether mobile-home occupants made their decision to live in a mobile home first, with other housing considerations following, or whether the budget constraint was considered first with other choices following. It may well be that, given these different approaches, a single model could not describe both processes accurately since in one case the decision to own a mobile home is exogenous and in the other it is endogenous. For this reason, two models were developed to estimate the demand for mobile-home housing. The first model to be discussed (Model A) is a tenure-choice model. It yields insight into the question "what type of family chooses to own its own home?" This model is then modified to deal with mobile-home ownership. The second model (Model B) is used to estimate demand for mobile-home housing services once the decision to own or rent a mobile home has been made.

Model A

Tenure choice is the biggest single decision a household makes when shopping for housing. This is the decision to rent someone else's property or to purchase

one's own. Several approaches to exploring this choice and how it is made have been attempted by a variety of researchers. Struyk and Marshall have published an article (1974, p. 289) which "is focused primarily on the relationship between tenure choice and income." Carliner published a similar article (1974) at approximately the same time which examines the same issue in a very similar manner.

Both research efforts use ordinary least squares (OLS) regression techniques to examine conventional home ownership. What is interesting about their work, however, is that the dependent variable in their models is discrete in nature. The dependent variable is defined as "home ownership." It takes on a value of 1 if the household owns (or is buying) its own home, and 0 otherwise. It is, in effect, a dummy dependent variable. For example, consider the following equation:

$$OWN = a + b(INCOME) + c(FAMSIZE) + d(YOUNG) + e(OLD)$$

where

OWN = tenure choice; if the household lives in its own home, OWN = 1; otherwise, OWN = 0

INCOME = family income, measured in dollars; this figure may be observed annual income or some measure of permanent income

FAMSIZE = a dummy variable for family size; if the number of persons in a family is five or

more FAMSIZE = 1; otherwise, FAMSIZE =0

YOUNG = a dummy variable for the age of the family's head; if the head's age is less than 30, YOUNG = 1; otherwise, YOUNG = 0

OLD = a dummy variable for the age of the family's head; if the head's age is more than 65, OLD = 1; otherwise, OLD = 0

a,b,c,d,e = numerical regression coefficients calculated from actual data

Income is the only variable measured continuously. While family size and age of head can be measured as discrete variables, they have been set up to define dummy variables in this example. For instance if the household head's age is 23, YOUNG = 1 and OLD = 0 for that household observation. If the head's age is 35, YOUNG = 0 and OLD = 0 for that household observation. If the head's age is 68, YOUNG = 0 and OLD = 1 for that household observation.

If household data are analyzed and the regression coefficients are calculated, we may find that:

$$OWN = 0.3 + .004(INCOME) + .008(FAMSIZE) - .20(YOUNG) - .15(OLD)$$

The dummy variables relating to age have coefficients which express the difference in probability of ownership from the "reference group." Since dummy variables were estab-

lished for "young" and "old" families, the reference group consists of families whose head is between 30 and 65 years of age. The coefficient of -.20 for YOUNG expresses the fact that the probability of home ownership for a "young" family is 20 percent less than the probability of ownership for a family whose head is over thirty, ceteris paribus. Likewise, the family whose head is over sixty-five is 15 percent less likely to own its own home than the reference group.

Both Carliner's and Struyk and Marshall's studies showed some demographic factors to be significant predictors of ownership probability. Additionally, Carliner's work estimates that the probability of home ownership (for his entire sample) goes up 1.62 percentage points for each $1,000 increase in observed 1966 income. That is to say, if a family's income rises $5,000 the probability of that family's owning its own home goes up over eight percent. Struyk and Marshall found income elasticities ranging from -0.276 for primary individual households where the person's observed 1969 income was over $20.000 to +1.90 for husband-wife families with incomes under $4,000. So the amount spent on housing depends not only on one's income, but also on marital status and other demographic characteristics.

A similar model was set up for Florida. The model is for explanation of home ownership. All types of owner-occupied housing are included. The model can be written as:

$$TENURE = b_0 + b_1(FAMINCOM) + b_2(DMARRIED) + b_3(DUMLE25) + b_4(DUMGE65) + b_5(DFEMHEAD) + b_6(DFMSZLE2) + b_7(DFMSZGE5) + b_8(DHDNONWH) + b_9(DEDLTHS) + b_{10}(DEDSC) + b_{11}(DEDCG) + b_{12}(DUMIGRAN) + b_{13}(DUMARMY) + b_{14}(DSTUDENT)$$

where

FAMINCOM = 1969 observed family income, in $100 units

DMARRIED = a dummy variable for marital status of the family head; 0 if single, 1 if married

DUMLE25 = a dummy variable for age; 0 if head is twenty-five or under, 1 if head is over twenty-five

DUMGE65 = a dummy for age; 0 if head is under sixty-five, 1 if head is sixty-five or over

DFEMHEAD = a dummy for sex of household head; 0 if male, 1 if female

DFMSZLE2 = a dummy for family size; 0 if more than two people, 1 if two or one

DFMSZGE5 = a dummy for family size; 0 if less than five people, 1 if five or more

DHDNONWH = a dummy for race of head; 0 if white, 1 if non-white

DEDLTHS = a dummy for educatonal attainment of head; 0 if high-school graduate, 1 if not a high-school graduate

DEDSC = a dummy for educational attainment of head; 0 if head never attended college, 1 if head did attend college

DEDCG = a dummy for educational attainment of head; 0 if head did not graduate from college, 1 if head did graduate from college

DUMIGRAN = a dummy for mobility; 0 if head lived in Florida five years ago, 1 if head moved into Florida between 1965 and 1970

DUMARMY = a dummy for armed services head; 0 if civilian, 1 if head is member of armed forces

DSTUDENT = a dummy for current enrollment status; 0 if head is not a student, 1 if head is enrolled in school

TENURE = a dichotomous variable which takes on a value of 0 if the dwelling is not owned by the family occupying it and takes on a value of 1 if the housing unit is owner-occupied for the ALL OWNERSHIP model; for the MOBILE-HOME OWNERSHIP version it takes

on a value of 1 if the family owns and lives in its own mobile home

First the equation was estimated for Florida's entire population (as sampled in the one-in-a-hundred Public Use Sample) by setting the dependent variable of home ownership equal to 1 if the household owns its dwelling, whatever type, and 0 otherwise. Fourteen independent variables were used in the model--thirteen dummies and one income variable. The income measure used was the 1969 observed family income, in $100 units. The dummy independent variables included one for marital status, two for age of head, one for sex of head, two for family size, one for race of head, three for head's educational attainment, one for migratory experience, one for head being employed in military service, and one for the head being a student. A constant term was calculated also, so the coefficient for each dummy variable represents the (percentage) deviation from the reference (unspecified) group for the specified group. For example, the summary of the ALL OWNERSHIP regression in Table 15 (Chapter V, page 100) shows that there were three educational groups specified--less than high-school graduate, some college, and college graduate. This group might be thought of as the "base group." The coefficient for each of the other groups (-.022, +.001, -.029, respectively) therefore represents the deviation from the base group for the group

in question. Families whose head is not a high-school graduate owned their own home 2.2 percent less often than families whose head was a high-school graduate.

The model was estimated for all owner-occupied housing units and then for all owner-occupied mobile homes. That is, the dependent variable was assigned a value of 1 when first, the ownership criterion was met, and, in the second version of the tenure-choice model, assigned a value of 1 when the ownership of a mobile home criterion was met. Estimating the all home ownership model first and comparing the results with the mobile-home ownership model should permit one to ascertain whether the same variables are useful in explaining mobile home ownership. Results of these estimations are discussed in Chapter V.

Model B

Once the decision to live in a mobile home has been made, the amount to be spent on such housing has to be determined. Also, to buy or to rent becomes an issue to be decided. Model B is a more conventional regression model which is estimated using the OLS technique. Use of this procedure is widely observed and it has proved to be a statistically powerful tool. The model is used to estimate expenditures for owner-occupied mobile-home services and then re-estimated for expenditures on renter-occupied mobile homes.

Owner-occupied mobile homes

Dependent Variable. Most housing studies which have estimated the demand for housing at the micro level have used either house value or housing cost as the dependent variable. Of the five cross-section studies of the demand for housing which de Leeuw reviews (1971, pp. 3-6), four use house value as their dependent variable. Most precisely, the demand for housing is a demand for housing services which, supposedly, any of a number of different types of physical dwelling units may be able to satisfy. The concentration in this research is on one type of dwelling unit--the mobile home. The utility provided by a mobile home which satisfies the demand for housing services is the basis upon which the demand for mobile homes is founded. This utility is not directly observable or measurable, but the dollars spent to satisfy the demand for housing services are observable and measurable. A new or used mobile home has a purchase price or value at the time of its purchase. This is the amount paid for the unit, either at the time of purchase or over a period of years. Because a mobile home provides housing services as long as it is occupied, however, it was felt that housing expenditure over this period of time was the best approximation of actual demand for these services. Therefore the dependent variable is dollars of expenditure for mobile home housing

per year. This measure of demand will take into account not only value at the time of purchase, but also the time period over which the unit is utilized. Expenditure will be defined here as the estimated purchase price divided by the time period over which the unit is occupied. The result will be annual housing expenditure.* Value of the mobile home will thus be needed as an input into determining annual expenditure.

Within the Public Use Sample house value has been collected for conventional housing units, but has not been collected for mobile homes. It was therefore necessary to estimate each mobile home's purchase price in order to derive expenditure. This would be the dollar amount to be paid by the new owner. Since this datum was not collected directly, it had to be derived on the basis of data which were collected directly.

For each household the following data, which were collected in the Public Use Sample, were utilized to arrive at an expense figure:

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*The expenditure measure developed in this manner does not necessarily correspond to that used in any other housing study. For example, this mobile home annual expense includes payment for appliances and furniture since virtually all units come equipped with these items, but does not include utility payments. Other studies of housing expense in which conventional structures were analyzed have dealt differently with these matters. Sometimes the researcher will figure expense inclusive of these items and in other cases they are omitted. Much the same variance is found with respect to utility payments, which are excluded in this study.

1. Number of rooms (NROOM)
2. Number of baths (NBATH)
3. Presence of air conditioning (AIRCON)
4. Presence of piped hot water (HOTWATER)
5. Presence of full plumbing (PLUMBING)
6. Type of sewerage (SEWAGE)
7. Source of water (WATERSOU)
8. Type of heating (HEATING)
9. Year in which unit was built (YRBILT)
10. Year in which family bought mobile home (YRMVD)

The value of a mobile home is primarily a function of its structural characteristics and its age. Items 1 through 8 relate to the structure of a unit and items 9 and 10 relate to a unit's age when it was purchased. Figure 3 is a schematic depicting how the actual items have been used.

Determining the value of a mobile home is a fairly straight-forward, commonplace procedure in some instances. For a new unit the value is defined as the market price. Also, for a used unit, its value can be ascertained as it passes through the market. The problem in valuation of the units involved in this present study, however, is that they are not passing through a market at the time of Census enumeration in 1970. And the Census Bureau did not ask for the owner's estimate of the value of the structure. This

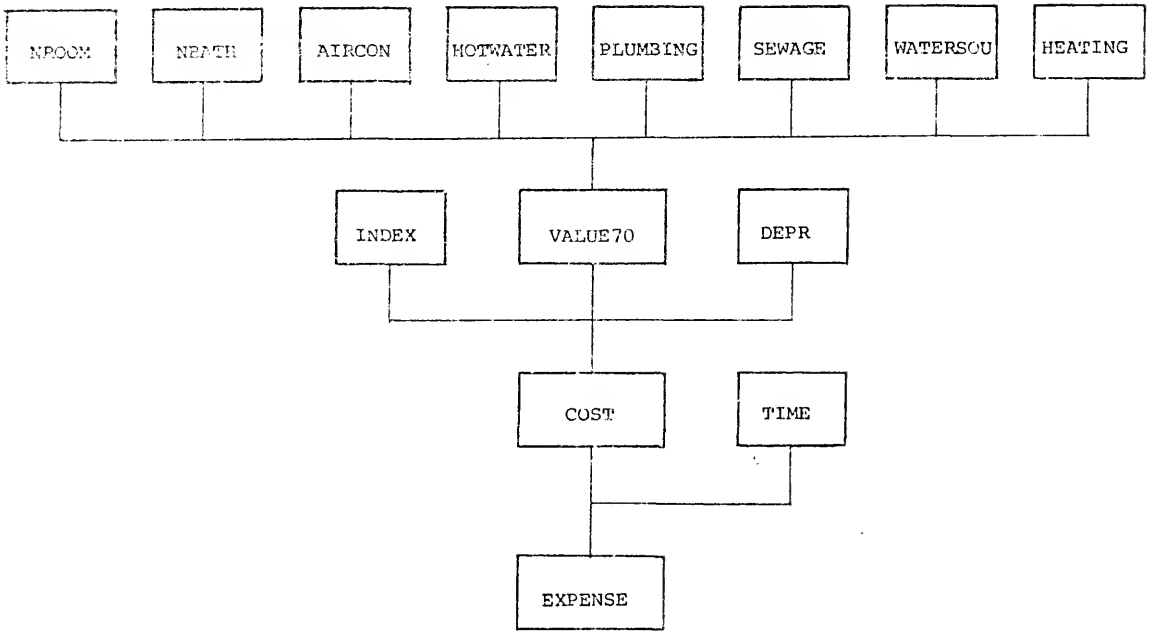

FIGURE 3
Determination of Mobile-Home Housing Expense

omission is unfortunate because it makes necessary a good deal of work to ascertain the values of enumerated units. This valuation is almost certainly less accurate than that which could have been obtained from the occupant who purchased the mobile home. But, if one wishes to use the wealth of information which is available from the Census, a valuation model for mobile homes can be constructed.

Within the mobile-home industry there are several publications used for placing a value on a used mobile home. The procedures and presentation of the information are very similar to those employed in the used car business. In fact, one of the publications is the Blue Book published by Judy-Berner and used widely by dealers. Another widely used data source is the Unicomp Directory of Used Mobile Homes. In these publications mobile homes are broken down by manufacturer, model, year built, size, and physical layout.

There are several "rules of thumb" used in the industry for depreciating a used mobile home. These "rules" might be used by a dealer in estimating trade-in value, but at best they are only a rough estimate of a unit's value. For instance, a dealer may use a rule such as: ten percent loss of value the first year and five percent per year thereafter. This would result in loss of one-half of original value after nine years' use. The rate of depreciation would be slower after that point. While such an estimating tech-

nique could be used, it was felt that actual resale experience would provide better data.

Data collected from a 1974 copy of the Unicomp Directory revealed the depreciation pattern reflected in Table 9. Depreciation actually computed from Unicomp data was derived only up to nine years of age. Beyond that age the rate of depreciation is based on the author's experience and discussions with people working in the mobile-home industry.

TABLE 9
Percent Depreciation by Age of Unit

Age	(Of New Price) % Value Loss	% of Original Value Retained
1	20	80
2	6	74
3	6	68
4	6	62
5	5	57
6	5	52
7	4	48
8	4	44
9	4	40
10	4	36
11	3	33
12	3	30
13	3	27
14	2	25
15	2	23
16	2	21
17	2	19
18	1	18
19	1	17
20	1	16

SOURCE: Unicomp Directory and discussions with industry personnel.

Table 10 shows the average value of new mobile homes produced from 1950 through 1970 and indexes average selling price of a new unit for each year. The index is computed from industry data which are published in Flash Facts. It is simply a way of expressing a new unit's selling price based upon average selling price in 1970. For instance, the 1959 index is .818 because the average new unit price of $4,996 in 1959 is 81.8 percent of the average new unit price of $6,110 in 1970. The year 1956 was when the ten-foot-wide unit came onto the market and 1963 was the first full year for the twelve-foot-wide unit.

The most significant determinant of the price of a mobile home of given age is its size. Strictly speaking, according to industry specifications, a mobile home must exceed eight feet in width and thirty-two feet in length. Anything smaller is a travel trailer. While conventional industry sizing is on the basis of dimensions (12' x 60', etc.), the census data is in terms of number of rooms and number of bathrooms. This discrepancy is offset by the fact that almost all mobile-home rooms are very nearly the same size. Second and third bedrooms are usually a foot or two smaller than average, and living rooms are quite often several feet longer than average. The values listed in Table 11, based on marginal cost of a room, were derived for 1970. The process used basically involved translating

TABLE 10
Average Value of New Mobile Homes by Year Built

Year	Average Value	Index
1970	6110	1.000
1969	6050	.990
1968	6000	.982
1967	5700	.933
1966	5700	.933
1965	5600	.917
1964	5600	.917
1963	5715	.935
1962	5602	.917
1961	5599	.916
1960	4995	.818
1959	4996	.818
1958	5000	.818
1957	4996	.818
1956	5003	.819
1955	4129	.676
1954	4276	.700
1953	4187	.685
1952	3855	.631
1951	3685	.603
1950	3423	.560

SOURCE: Flash Facts: Pocket Reference to the Mobile Home Industry, MHMA, June 1974.

number of rooms plus number of baths data into a dollar value. An intermediate step in the process involves matching up the number of rooms with conventional industry sizing (number of feet long). For instance, a unit with four rooms and one bath is probably between 52 and 58 feet long, while a unit with five rooms and one and a half baths is probably 64 or 65 feet long.

There are no mobile homes with only one room being produced now. They are included here for the purpose of

TABLE 11
Value of New 1970 Mobile Homes

Number of Rooms	Number of Baths	Value
1	1	3,200
2	1	4,200
3	1	5,400
4	1	6,200
4	1½	7,000
5	1	8,100
5	1½	8,900
5	2	9,400
6	1	10,700
6	1½	11,500
6	2	12,000
7	1	12,700
7	1½	13,500
7	2	14,000
8	1	12,900
8	1½	13,700
8	2	14,200
9	1	14,300
9	1½	15,100
9	2	15,600

evaluating old units counted in the census. Under this number-of-rooms approach, it is assumed that a unit with more than five rooms is more than a single unit wide. The model developed here is based on the marginal cost of an additional room or bath. As nearly as possible, this technique is designed to coincide with the industry's conventions for sizing.

Other structural characteristics influence a unit's value. Table 12 reflects how these factors are taken into account in the valuation model presented here.

TABLE 12
Characteristic Components in Mobile Home Valuation Model

Characteristic	Adjustment to Value
1. 1 room air conditioner	+200
2. 2 or more room air conditioners	+400
3. Central air conditioning	+600
4. Room heaters with flue	-100
5. Room heaters without flue	-300
6. Portable room heaters	-400
7. No heating equipment	-400
8. Lacks piped hot water	-200
9. No plumbing facilities	-300
10. No piped water	-300
11. Water from individual well	-100
12. Water from other nonpublic source	-200
13. Septic tank sewerage	-100
14. Other nonpublic means of sewerage disposal	-300

Items 1 through 10 are actual structural characteristics of individual units. The dollar adjustments are estimates of the actual cost of adding the service mentioned or of the loss of value represented by the absence of the particular feature.

Items 11 through 14 deal with water and sewerage which actually are not part of the unit, but which are proxies reflecting the type of environment in which the unit is placed. These items hopefully parallel quality differences in units. For example, it is in the "adult mobile home" communities that one is most likely to find custom-built units. It is also in these parks that one is most likely to find public or municipal water and sewerage sys-

tems. On the other hand, a unit placed on a rural lot where water is from an individual well and a septic tank handles sewerage is least likely to be a custom designed or built unit. Some account of quality variation is the raison d'etre for items 11 through 14.

Drawing these pieces of information together is the next step in the valuation model. The items listed in Tables 11 and 12 are summed to arrive at a fictional entity called VALUE70. VALUE70 is what every mobile home would sell for (based on its structural characteristics) if it was built and bought in 1970. This step standardizes units in terms of 1970 dollars. VALUE70 is then indexed for the year in which the unit was actually built. Table 10 constructed from industry data, is used for this purpose. The unit is then depreciated (in accordance with industry experience as depicted in Table 9) in accordance with its age when it was purchased. The product of VALUE70 and INDEX and DEPRECIATION yields COST. This is the calculated market value of the mobile home when it was purchased by the household under observation. For example, a four-room, one-bath unit connected to a water and a sewerage system would assume a VALUE70 value of $6,200. If this unit had been built in 1966 INDEX would assume a value of .933. Therefore, the computed value of the unit when it was constructed is (VALUE70) x (INDEX) = ($6,200) x (.933) = $5,785.

This is the estimated value of this new unit. If it were bought new then it would not be depreciated to find its purchase price. If, however, this 1966 mobile home had been purchased by its occupants in 1968, it would have been two years old at that time. A depreciation factor, obtained from Table 9, would need to be used to find the unit's value when it was purchased. This factor is .74 for a two-year-old unit. Applying .74 to the previously computed value of $5,785 yields (($5,785) x (.74)) = $4,281. This is the estimated cost of the mobile home when it was purchased by its current (in 1970) occupant. Deriving annual housing expense involves one further step.

COST is divided by the number of years which the family has lived in the unit. If this period of time is less than five years, it is set equal to five. This choice of five years was made because a study published by the Florida Mobilehome and Recreational Vehicle Association in February of 1971 (Cubberly, 1971, p. 30) revealed that the mean length of time that 1,978 Florida mobile-home resident households had lived in their mobile homes was 5.3 years. The same survey (p. 31) found that the mean length of residency at the same address for its sample of mobile-home households was 3.7 years. So COST divided by TIME yields annual housing EXPENSE. Even though a mobile home depreciates after it is purchased, the financial obli-

gation is fixed at the time of purchase and is not affected by depreciation. This expense is defined and constructed so that site value is not included in housing expense. The owner can choose how much he wishes to spend for site value apart from his decision of how much to spend for his housing unit. Cost of appliances and furniture for the unit is included in EXPENSE, however. The cost of credit is not figured in. This seems preferable since financing is a service unto itself and need not be bought through a mobile-home dealer. In fact, a suprisingly high percentage (85) of families who purchased their own mobile home in Florida have been found to owe nothing on the unit (Cubberly, 1971, p. 29). It is for these reasons and the nature of the data that EXPENSE is defined as just explained. "Annual housing expense for mobile home" is, therefore, the dependent variable in the model to be estimated.

Independent Variables. The relationship of primary importance in this research is that between expenditures for mobile-home housing and family income. This relationship is measured by the concept of income elasticity of demand which is defined as the relative change in expenditure compared to the relative change in income. For example, if a family's income increases 20 percent and its expenditure on steak increases 25 percent, the family's income elasticity of demand for steak is .25/.20, or 1.25. This general relationship has been examined extensively in the

housing literature (see Chapter II) for conventional housing--both renter and owner-occupied, but has not been explored with mobile home housing. Because of the interest in this relationship, definition of income is of prime importance.

Income variables. It has generally been concluded that the use of one year observed income as an explanatory variable in demand estimation is inappropriate. Income elasticities calculated using measured income understate the true relationship because consumption decisions, especially for durable goods, are made on the basis of a concept of income which is much broader than one year's receipts. Milton Friedman (1957) is the person usually given credit for breaking ground in the area of a theoretical basis for "permanent income." He concluded that consuming units tend to have a three-year period in mind when evaluating their income. It seems almost certain that housing decisions are based on an even longer time horizon.

What concept of income is appropriate for use with mobile-home demand? Several key factors come to mind. When housing payments are known in advance and must be met regularly, a cash flow concept for housing service becomes the relevant consideration. Liquidation of non-liquid assets, while possible, is not the norm for meeting such a regular financial obligation. It is possible that such ac-

tion may take place during the early stages of long-term debt repayment on the basis of higher expected income, however. This might involve liquidating assets to make a down payment, but regular debt repayment does not normally involve such portfolio management.

Most individual's incomes are directly related to how much they earn per unit of time and how much time they work (labor-force participation). The exception is income from non-work sources, and this is important to persons not in the labor force and to persons with substantial investment income. Also of importance are a person's occupation, education and experience (human capital), and, his sex and race.

In developing a concept of permanent income (which is, itself, not directly observable) these factors should be used as inputs. Three variants of permanent income, each embodying different assumptions, were calculated and tested, along with observed 1969 income, for their appropriateness and predictive power. These variants, YPERMFAM, FMINTR, and INCFAM, are estimates of permanent income, each based on slightly different assumptions.

The YPERMFAM concept is "pure permanent income" as developed in this study. It takes no account of 1969 experience and is an income measure based solely on each person's occupational group, attributes, and human capital.

Development of the earnings model used to ascertain permanent income for each person in the mobile-home sample will now be presented.

The one-percent Public Use Sample for the state of Florida contains 40,790 person records. Those persons who had no 1969 income were excluded from those who formed the basis for the earnings model being developed. Then, for each of the twelve major occupational groups identified by the U.S. Bureau of the Census, a regression model was estimated to predict individual yearly earnings. The model for each occupational group is in the general form:

$$\log(\text{earnings}) = b_0 + b_1(\text{education}^2) + b_2(\text{experience}) + b_3(\text{experience}^2) + b_4(\text{sexdummy}) + b_5(\text{racedummy}) + b_6(\text{Spanish-Americandummy})$$

where:

education = the highest year of school attended

experience = (1969 age) - (6) - (education)

sexdummy = 1 if female, 0 otherwise

racedummy = 1 if nonwhite, 0 otherwise

Spanish-Americandummy = 1 if Spanish-American, 0 otherwise

This form is not unlike that often used in the human capital literature. (See, for example, Mincer, 1974, pp. 91-93, or Grossman and Benham, 1974, pp. 205-233.)

The earnings term, which is the dependent variable, is expressed in log form so that its variance is made uniform. The statistical rationale for this transformation can be found, among other places, in Mendenhall's text (1968, p. 206) on linear models. The education term is squared because there is evidence that the earnings-schooling relationship is not linear. The experience terms also are specified in a non-linear form. The expected relationship between earnings and age is the familiar inverted U. Experience, rather than age, is the variable used, however, since it appears to perform better (in terms of R^2) in some instances. For purposes of this work, experience was defined as age minus years of schooling minus six (age at which most people start school). Additionally, precautions were taken so that persons with little or no schooling were not allowed to enter the labor force before age sixteen in the model. The dummy variables take account of racial and sex differences. The variable coefficients, with F statistics in parentheses, are presented in Table 13.

To demonstrate the operation of the model and the use of the calculated coefficients, examining a hypotheti-

TABLE 13
Coefficients for Income-Generating Model

Occupation	b_0	b_1	b_2	b_3	b_4	b_5	b_6	F	R^2	Cases	%
Professional and Technical	3.52262	0.00087 (9.06)	0.02660 (18.08)	-0.00055 (17.53)	-0.33582 (25.19)	0.03182 (1.18)	0.00898 (0.31)	184.87	0.26837	3,031	14.65
Managers and Administrators	3.52083	0.00130 (10.60)	0.02119 (10.55)	-0.00037 (10.32)	-0.34659 (16.82)	-0.15920 (3.10)	0.05126 (1.53)	94.55	0.22974	1,909	9.23
Saleswerkers	3.49220	0.00085 (4.56)	0.02074 (9.89)	-0.00039 (10.67)	-0.54361 (25.59)	-0.02942 (0.42)	-0.03703 (0.84)	150.81	0.34765	1,705	8.24
Clerical	3.48207	0.00068 (4.71)	0.02060 (15.96)	-0.00039 (15.29)	-0.31760 (21.52)	-0.02743 (1.02)	-0.00804 (0.31)	129.54	0.16882	3,834	18.53
Craftsmen	3.61677	0.00032 (2.94)	0.01877 (14.86)	-0.00039 (17.90)	-0.32178 (14.32)	-0.14948 (7.42)	-0.06113 (2.90)	108.47	0.17614	3,051	14.74
Operatives	3.47006	0.00069 (4.26)	0.01717 (9.32)	-0.00032 (10.04)	-0.38339 (24.17)	-0.09445 (4.40)	-0.00720 (0.34)	124.12	0.28052	1,917	9.26
Transportation Equipment Operators	3.56458	-0.00039 (1.75)	0.02138 (7.51)	-0.00044 (8.77)	-0.44956 (11.15)	-0.07967 (3.03)	-0.04193 (0.93)	35.07	0.21931	756	3.65
Laborers	3.49175	-0.00003 (0.10)	0.01604 (6.38)	-0.00034 (8.47)	-0.44353 (9.91)	-0.06192 (2.23)	-0.01640 (0.32)	30.63	0.17900	580	4.11
Farmers and Farm Managers	4.00579	-0.00105 (1.14)	-0.01367 (0.67)	0.00000 (0.00)	-0.33173 (1.22)	-0.18010 (0.55)	0.00449 (0.00)	2.78	0.26214	54	0.26

TABLE 13--Continued

Occupation	b_0	b_1	b_2	b_3	b_4	b_5	b_6	F	R^2	Cases	%
Farm Laborers and Foremen	3.30694	0.00085 (2.02)	0.01455 (3.49)	-0.00028 (4.31)	-0.49868 (13.27)	0.08826 (2.26)	-0.15604 (1.70)	38.44	0.32729	481	2.32
Service Workers	3.31764	0.00082 (4.80)	0.02135 (12.92)	-0.00040 (14.19)	-0.39290 (23.31)	-0.02272 (1.19)	0.00328 (0.11)	125.82	0.22719	2,575	12.44
Private Household Workers	3.42209	-0.00029 (0.67)	0.00659 (1.43)	-0.00016 (2.33)	-0.46730 (4.63)	0.08360 (1.62)	-0.07921 (0.38)	5.91	0.06342	531	2.57
AVERAGE	3.4894	0.00065	0.0203	-0.0004	-0.3757	-0.0529	-0.0156			20,694	100.00

cal individual might be useful. Consider an individual with the following characteristics in 1969: male, age 36, caucasion, college graduate, an engineer by vocation. The model can be used to generate a hypothetical income for this individual for 1969. Since he is an engineer, he would be in the Professional and Technical occupation group and the coefficients for that group would be used to generate his permanent income:

$$\begin{aligned}\log(\text{earnings}) &= 3.52262 + 0.00087(16^2) + 0.02660(14) \\ &\quad - 0.00055(14^2) - 0.33582(0) \\ &\quad + 0.03182(0) + 0.00898(0) \\ &= 3.52262 + 0.22272 + 0.37240 - 0.10780 \\ &\quad - 0 + 0 + 0 \\ &= 4.00994 = \$10,232\end{aligned}$$

If this engineer had been a female, her generated 1969 income would have been lower because the dummy variable taking into account sex would have taken on a value of 1 (rather than 0 for a male) and the log(earnings) value would be reduced by 0.33582. Earnings can be generated for the same person over a period of years to get total income over that time period.

This model can be used to generate incomes which can be used for construction of a permanent income concept. In essence this model produces average incomes, with unusually high and unusually low ones canceling one another

out to some extent. Variations such as these may well be attributable to transitory factors--the effects of which permanent income seeks to minimize.

Use of these models allows movement of an individual "through time." Permanent income, for purposes of this demand study, was derived to include the time period during which a family had lived in its mobile home or was projected to live in it. For example, a family which bought its mobile home in 1963 would have lived in it for seven years in 1970. Consequently, the period of income generation relevant to the family in question is from 1963 to 1970. The model can be used, for this hypothetical family, to generate incomes for each adult person in the family for each year in the period. These generated annual incomes are then totaled and divided by the number of years involved to get a permanent income measure for the time period during which the family was consuming mobile-home housing services. The permanent incomes for the household's head and for the wife (if she exists) are then added to get the family's permanent income.

YPERMFAM is one variant of permanent income. It completely ignores an individual's own earnings experience in favor of what that person's peers (in terms of occupation, education, experience, race, and sex) have experienced. This is in line with the theoretical construct of permanent

income which seems to eliminate individual, transitory fluctuations of income.

FMINTR is a variant of permanent income which explicitly assumes that the 1969 observation of an individual's income was not a randomly generated figure, but was based on circumstances or attributes which were not of a transitory nature. As an example, consider the following hypothetical family:

	(A) 1969 Observed Income	(B) 1969 Generated Income	(C) (A)/(B)	(D) YPER-MFAM	(E) FMINTR (C) x (D)
Head	12,000	9,000	1.33	15,000	19,995
Wife	4,000	6,000	.67	7,500	4,995
Family	16,000	15,000		22,500	24,990

In this family, the husband earned $3,000 more in 1969 than the earnings function outlined in the previous section had estimated he would earn. The wife earned $2,000 less than predicted for 1969. The ratio of observed to generated incomes is applied for both husband and wife and the resulting figures are summed to get FMINTR. In this case, perhaps the husband is a better engineer than his peers, and hence the 1969 income he earned is based on "permanent" factors. Likewise, perhaps the wife worked only half-time in 1969 and this is a "permanent" employment posture for her. FMINTR assumes that the observed 1969 experience for both husband and wife is not the result of temporary factors.

This variant of permanent income may be best where this assumption holds. Otherwise, it would be a poor measure of permanent income. The next concept introduced embodies a different assumption.

INCFAM is another variant of permanent income. It sums the husband's generated permanent income and the wife's observed 1969 income. The rationale behind this concept is that the norm for the husband is full-time employment, but what was observed in 1969 for the wife is her norm. If her 1969 income was low because she worked only half-time, perhaps half-time was her regular work routine. So INCFAM is a permanent income-observed income hybrid.

The FAMINCOM variant of income is simply observed 1969 family income. It is not permanent income, but actual 1969 experience. It is the sum of 1969 income for the household head and the spouse, if one is present.

Price variable. As mentioned in the first section of this chapter, economic theory suggests that the price of a good and the prices of other "competing" goods be included in a model of demand. In an effort to do so in the present model, a price index was constructed. This PRICE variable for mobile homes is actually a relative price measure. It is defined as the average cost of a mobile home divided by the average cost of construction of a conventional single-family house for the year in which the

family purchased its mobile home. Recognizing that this is a crude measure of prices, it should be added that data for a more appropriate set of prices are extremely difficult to ascertain. For instance, one might suspect that a price variable based on rental housing costs would also be useful. Or perhaps the price variable should be based on both the costs of ownership and of renting. Any single price measure will necessarily be an abstraction from reality. The further removed from real-world alternatives, however, the less likely a price variable would be to capture the influence exerted by actual price variation among alternatives. Depending upon one's financial capability, the range of choices may include owning or renting new or old property. While rising costs of new units may exert some upward pull on the price of older units, an older unit could be depreciating at a faster rate than new construction costs are rising. So ultimately the price of a unique housing unit may be a unique price. Unfortunately no price variable which includes rental housing cost could be found or constructed. The problem is a lack of data. While construction costs do vary from place to place, materials are transportable, and labor costs do not vary greatly since most carpenters are unionized. But construction costs, even if estimable, are only one component of the total cost of securing housing. Supply and demand forces are also of

primary importance, and these forces vary considerably from city to city and from county to county. Consequently, a standard type of rental housing might rent for significantly different rates in different places. A price variable reflecting the price of rental housing would then need to be available by area for the years in which the sampled families made their mobile-home housing choice. These data are not to be found. A rental price index was developed for each Florida county for 1960 and 1970. A price variable for non-census years could not be constructed, however, and the concept of a more comprehensive price variable had to be abandoned. Table 14 shows the price variable which was used from 1950 through 1970.

Other independent variables. The NPERSON variable is simply the number of persons in the household. A positive correlation between family size and demand for shelter space would seem appropriate.

DUMGE65 and DUMLE25 are two age-related dummy variables utilized as independent variables because of the importance of the life cycle in housing demand. Two dummy variables are used because it was felt that the bimodal age distribution found by other researchers might be the case in Florida also.

The DUMRACE dummy variable takes on a value of 1 if the household head is nonwhite, but is 0 otherwise. The

TABLE 14
Relative Prices of Conventional and Mobile Homes

Year	Avg. Cost of Mobile Home ($)	Avg. Cost of Conventional House ($)	Price Ratio
1950	3,423	8,675	.3946
1951	3,685	9,300	.3962
1952	3,855	9,475	.4069
1953	4,187	9,950	.4208
1954	4,276	10,625	.4204
1955	4,129	11,350	.3638
1956	5,003	12,225	.4092
1957	4,996	13,025	.3836
1958	5,000	12,950	.3861
1959	4,996	13,425	.3721
1960	4,995	13,725	.3639
1961	5,599	13,825	.4050
1962	5,602	14,325	.3911
1963	5,715	14,875	.3842
1964	5,500	15,425	.3630
1965	5,600	16,150	.3467
1966	5,700	16,750	.3403
1967	5,700	17,325	.3290
1968	6,000	18,525	.3239
1969-1970(I)	6,062	19,045	.3184

SOURCE: Mobile Home Manufacturer's Association and Statistical Abstract of the U.S., various years.

purpose of its existence is to allow examination of whether nonwhites consume less mobile-home housing services (i.e., demand less) than whites do.

DUMHDSEX is a dummy that takes on a value of 1 if the household head is female. Its presence will allow us to determine whether female-headed households demand the same amount of mobile-home housing services as do male-headed households.

DUMIGRAN is another dummy variable. Its purpose is to aid in determining whether recent movers to Florida demand more or less housing than do more permanent residents.

DUMEDUCA is a dummy variable which takes on a value of one only if the household head has less than a high-school education. Its presence is to allow examination of the hypothesis that lesser-educated people live in mobile homes.

Renter-occupied mobile homes

Model B was also estimated for those families in the Florida Public Use Sample who were renting a mobile home in 1970. The model is unchanged except that housing expense is directly available from the data base. For purposes here rental expense is defined as annual contract rent. It is different from owner's expense in that some part of the rent payment goes for site value whereas mobile-home owner's expense excludes site value payments. To adjust for this difference, Model B was estimated twice for mobile home renters: the first time using actual contract rent as housing expense and the second time using three-fourths of actual contract rent as housing expense. This adjustment is an attempt to separate payment for housing space from payment for living environment.

Model Specification

"The mathematical form of the demand equation cannot be specified a priori in the present state of the art" (Houthakker and Taylor, 1970, p. 8). Some of the most often-used forms are:

1. Linear ($Q = b_0 + b_1 Y$)
2. Semi-logarithmic ($Q = b_0 + b_1 \log Y$)
3. Double-logarithmic ($\log Q = b_0 + b_1 \log Y$)
4. Inverse semi-logarithmic ($\log Q = b_0 + b_1 Y$)

Each of these specifications can be legitimately estimated. It cannot be stated which one will predict better than the others. The only way in which it can be stated with certainty that one specification is superior to the others is to have tried all the alternatives and to have chosen the one that performs best according to the decision rules for making one's choice.

There may be reasons for preferring one form to another other than predictive power, however. The need to standardize the variance for all cases of the predicted dependent variable, as mentioned earlier, is one such reason. What is known about the probability distribution of the dependent variable values may be sufficient cause for making a (logarithmic) transformation. The variance of the depen-

dent variable can frequently be stabilized by performing such a transformation on the dependent variable. A logarithmic transformation (base 10 or base e) is handy for use with positive-valued variables which may cover a wide range.

> In the physical sciences, there are often sound theoretical reasons for postulating a specific model. . . . Because social behavior is less predictable than physical phenomena, mathematical models are a less accurate approximation of reality in the social sciences, hence statistical methods are more necessary. . . . A mathematical model provides a useful structure with which an economist may perhaps better understand and predict economic phenomena; it can hardly be regarded as ultimate truth. In fact, in certain instances a mathematical model may be used even when it is known not to be exactly right, if it is "good enough." At our present level of knowledge, it is often better to use a simple, more tractable model rather than a complicated one--even though the latter provides a somewhat better fit. This is especially true if there are no prior grounds for expecting that the complicated model better describes the real world (Wonnacott and Wonnacott, 1970, pp. 99-101).

The double log form is used in Model B (for housing expense and income) for several reasons. First, such specification assumes that housing-income relationships tend to be linear when these two variables are expressed in log form. Second, this formulation yields income coefficients which are the income elasticity of housing expense. This outcome results because expenditure changes and income changes are expressed in relative, rather than absolute terms. When the functional form is set up in this manner

the relationship between housing and income is most readily observable.

The two models just outlined, with the pool of independent variables enumerated for each, were estimated using OLS techniques. Model A looks at the tenure decision--wehther a family chooses to own or rent. It then is used to get some indication of the relevant factors influencing a decision to own a mobile home. By default, the decision not to own usually means renting. Results of this model should be analyzed with this in mind. Model B is used for those families who had, in 1970, chosen to live in a mobile home. First the model is estimated for owners and then it is estimated for renters. Results of both models are presented in Chapter V.

CHAPTER V
EMPIRICAL FINDINGS

The two models to be estimated should help answer the questions (1) what types of families are inclined toward mobile-home ownership and (2) how does mobile-home usage vary as incomes change? We have learned a good deal about patterns of housing consumption for conventional housing over the years, but the mobile home is a product of the second half of the twentieth century. Even though this "new" form of housing has been gaining acceptance at a fairly rapid pace, little scholarly work on the economics of mobile-home housing has been done. Many people still think of the average mobile-home user as a gypsy who travels about with his "trailer" behind him. This concept is far from realistic for a housing alternative which may be as large as 1,700 square feet of floor space. Indeed, travel trailers, as popular as they have become for recreational purposes, do not qualify as mobile homes by industry standards. Mobile homes are permanent housing and are an increasing proportion of our permanent housing stock.

Two different models have been estimated for the purpose of gaining insight into the use of mobile-home housing and the economics of this housing alternative. Each

of these models can stand on its own, but when the results are looked at together, a better understanding of how they support one another is possible.

Model Estimation: Model A

The tenure model described in the previous chapter was first estimated for all households in Florida which had incomes in 1969. This "all household" version includes not only mobile-home owners and renters, but all households in the Public Use Sample. The dependent variable, called TENURE, takes on a value of 1 when the family owns its dwelling unit and remains 0 when it is not owned. Almost without exception the alternative to owning is renting. The list and definitions of the independent variables used are presented in Chapter IV. The functional form is:

$$\begin{aligned} \text{TENURE} = b_0 &+ b_1(\text{FAMINCOM}) + b_2(\text{DMARRIED}) + \\ &b_3(\text{DUMLE25}) + b_4(\text{DUMGE65}) + \\ &b_5(\text{DFEMHEAD}) + b_6(\text{DFMSZLE2}) + \\ &b_7(\text{DFMSZGE5}) + b_8(\text{DHDNONWH}) + \\ &b_9(\text{DEDLTHS}) + b_{10}(\text{DEDSC}) + \\ &b_{11}(\text{DEDCG}) + b_{12}(\text{DUMIGRAN}) + \\ &b_{13}(\text{DUMARMY}) + b_{14}(\text{DSTUDENT}) \end{aligned}$$

When all fourteen independent variables were forced into the model, only two were not significant at the 5 per-

cent level. The results are presented in tabular form in Table 15. Eleven of the independent variables are significant at the one-percent level (as indicated by the F statistics) and the equation's F statistic is over 300. R^2 for the equation is .16.

The relationships, as indicated by the signs of the coefficients, are in most instances as expected for ownership. The exceptions, to this writer's way of thinking, include female-headed families (5.8 percent more likely to own), college-graduate-headed families (2.9 percent less likely to own), and recent movers to Florida (22.2 percent less likely to own). This last one mentioned is not so surprising in its sign, but in the absolute size of the coefficient and its significance level.

Careful analysis of the coefficients yields some interesting predictions. For instance, using the information gleaned from this model, what are the characteristics of the family most likely to own its own home? Marital status of the household head would be married and the head would therefore be a male. If the head is 65 or over the likelihood of ownership is maximized. Intermediate family size (either three or four persons) is conducive to ownership; also, if the household head has some college education, the probability of ownership is increased. And since the income coefficient is positive, the higher the family

TABLE 15
Tenure Model Estimation

	All Ownership		M. H. Ownership	
	b	F	b	F
DMARRIED	-0.20577	387.02**	0.01682	9.21**
DUMLE25	-0.31690	750.19**	0.01596	7.20**
DUMGE65	0.05109	45.17**	0.02079	26.98**
DFEMHEAD	0.05842	27.43**	-0.00991	2.83
DFMSZLE2	-0.06074	66.81**	0.03295	71.62**
DFMSZGE5	-0.00118	0.02	-0.01272	7.13**
DHDNONWH	-0.18708	392.51**	-0.05214	116.71**
DEDLTHS	-0.02206	9.36**	0.01108	8.51**
DEDSC	0.00119	0.02	-0.01595	9.78**
DEDCG	-0.02888	6.54*	-0.02195	13.55**
FAMINCOM	0.04300	94.14**	-0.00900	71.33**
DUMIGRAN	-0.22177	1065.83**	0.01632	20.48**
DUMARMY	-0.15140	54.89**	0.02757	6.45*
DSTUDENT	-0.10601	35.74**	0.01678	3.66
CONSTANT	0.61229		0.04374	
Equation R^2	.1616	308.37**	.0317	58.11**
Critical F:		5% = 3.84		1% = 6.64

*Significant at 5%
**Significant at 1%

income, the more likely is ownership. If the family's 1969 income had been $15,000 for instance, what would the model predict the possibility of ownership to be?

$$\begin{aligned} &\text{CONSTANT} + \text{DMARRIED} + \text{DUMGE65} + (\text{Median Size Family}) \\ &\quad + \text{DEDSC} + \text{FAMINCOM} = \\ &.61229 + .20557(1) + .05109(1) + 0.0 \\ &\quad + .00119(1) + (.00043)(150) = .93464 \end{aligned}$$

The model estimates the probability of home ownership to be a 93.46 percent chance of owning its own home for this family. The choice of characteristics is such that, for every categorical variable, that alternative for increasing ownership probability was chosen. If this same family's income had been $25,000 instead of $15,000, the probability of ownership would increase from 0.93464 to 0.97764. At the other extreme, a family highly unlikely to own its own home, according to this model, exhibits the following characteristics: a single male under twenty-five years of age who is a student and has moved to Florida since 1965. The lower his income, the less likely he is to own. This person, with an income of $5,000, would have a probability of ownership of -0.01090. Such a negative probability is logically impossible since, by definition, probability must range only between 0 and 1. The model does not operate asymptotically so that, given a set of extreme character-

istics and a very low or high income, the model will generate a solution below zero or above one.

As one might guess, there are some multicollinearity problems presented by using several variables which catch the same people. Correlation ccefficients for the independent variables are presented in Table 16. The most severe confounding problems arise between the dummy variables for "marital status" and "head of household being female." This arises because, by census definition, a couple is headed by the male. The variable for "some college" also picks up "college graduate." This model possibly could, from a statistical point of view, be improved slightly by dropping out several of the confounding variables. The cost of doing so with almost 25,000 household observations would be high and, other than the relatively high correlation just noted, no other problem seems to have been caused by leaving in all categorical variables for the sake of completeness. Further manipulation of ths model was, therefore, not undertaken at this time.

Also summarized in Table 15 are the results of the tenure regression when the dependent variable took on a value of 1 only when the household owned its own mobile home. Again, eleven of the independent variables proved to be significant at the 5 percent level--though not the same eleven as in the first version of the model. Those variables significant at the one percent level are denoted

TABLE 16
Linear Correlation Matrix for All Owner Tenure Model

	TENURE	DUMLE25	DUMGE65	DFEMHEAD	DFMSZLE2	DFMSZGE5	DHDNONWH
TENURE	1.00000	-0.22711	0.03083	-0.11266	-0.10288	0.05470	-0.13832
DUMLE25	-0.22711	1.00000	-0.17581	-0.03433	-0.00621	-0.07431	0.02518
DUMGE65	0.03083	-0.17581	1.00000	0.16271	0.42337	-0.23859	-0.08628
DFEMHEAD	-0.11266	-0.03433	0.16271	1.00000	0.23180	-0.12560	0.10284
DFMSZLE2	-0.10288	-0.00621	0.48337	0.23180	1.00000	-0.48560	-0.10520
DFMSZGE5	0.05470	-0.07431	-0.23859	-0.12560	-0.48560	1.00000	0.14668
DHDNONWH	-0.13832	0.02518	-0.08628	0.10284	-0.10520	0.14668	1.00000
DEDLTHS	-0.01831	-0.11971	0.19346	0.04307	0.07621	-0.00212	0.20807
DEDSC	-0.00164	0.08774	-0.10389	-0.06074	-0.02931	-0.00478	-0.15221
DEDCG	0.00217	0.01249	-0.06667	-0.06339	-0.02390	0.00665	-0.09889
FAMINCOM	0.16377	-0.09556	-0.24307	-0.28829	-0.24943	0.15122	-0.17419
DUMIGRAN	-0.20935	0.08769	-0.03112	-0.09125	0.02510	-0.01543	-0.12359
DUMARMY	-0.09485	0.13958	-0.08963	-0.07727	-0.06851	0.03808	-0.02348
DSTUDENT	-0.09640	0.23212	-0.08627	-0.02513	-0.00910	-0.01820	-0.00977
DMARRIED	0.18836	0.01721	-0.17676	-0.77264	-0.33220	0.17914	-0.11802

TABLE 16--Continued

	DEDLTHS	DEDSC	DEDCG	FAMINCOM	DUMARMY	DSTUDENT	DMARRIED
TENURE	-0.01831	-0.00164	0.00217	0.16377	-0.09485	-0.09640	0.18836
DUMLE25	-0.11971	0.08744	0.01249	-0.09566	0.13958	0.23212	0.01721
DUMGE65	0.19346	-0.10389	-0.06667	-0.24307	-0.08963	-0.08627	-0.17676
DFEMHEAD	0.04307	-0.06074	-0.06339	-0.28829	-0.07727	-0.02513	-0.77264
DFMSZLE2	0.07621	-0.02931	-0.02390	-0.24943	-0.06851	-0.00910	-0.33220
DFMSZGE5	-0.00212	-0.00478	0.00665	0.15122	0.03808	-0.01820	0.17914
DHDNONWH	0.20807	-0.15221	-0.09889	-0.17419	-0.02348	-0.00977	-0.11802
DEDLTHS	1.00000	-0.54269	-0.34800	0.26007	-0.09703	-0.11168	-0.05798
DEDSC	-0.54269	1.00000	0.64124	0.27536	0.04086	0.22423	0.04797
DEDCG	-0.34800	0.64124	1.00000	0.27860	0.01871	0.11736	0.05012
FAMINCOM	-0.26007	0.27536	0.27860	1.00000	-0.01741	-0.02029	0.31630
DUMIGRAN	-0.08737	0.08755	0.07586	0.00100	0.17927	0.03948	0.06962
DUMARMY	-0.09703	0.04086	0.01871	-0.01741	1.00000	0.03189	0.07805
DSTUDENT	-0.11168	0.22423	0.11736	-0.02029	0.03189	1.00000	-0.00926
DMARRIED	-0.05798	0.04797	0.05012	0.31630	0.07805	-0.00926	1.00000

by two asterisks in Table 15. Ten of the variables proved to be significant at the 5-percent level in both the all-household and the mobile-home versions of the model. These are denoted by a single asterisk. Of these ten, however, the relationship, as evidenced by the sign of the coefficient, was different for six of the ten which were significant in both versions. Those significant variables which had the same sign in both the all-ownership and the mobile-home ownership versions of the tenure model are the dummy variables for marital status, families headed by a person over sixty-five, families headed by a nonwhite person and families whose head had graduated from college. These four variables were statistically significant at least at the five-percent level and in both versions of the model, influenced the probability of ownership in the same direction--positively for being married and having a head over sixty-five, and negatively for having a nonwhite family head and having a college-graduate head. The other six variables which proved to be significant in both versions experienced a sign change between the versions.

Five variables influenced home ownership in a negative way, but mobile-home ownership positively. These are DUMLE25, DFMSZLE2, DEDLTHS, DUMIGRAN, and DUMARMY. Having a young family head, a small family, a family head who did not finish high school, or a mobile family (as exhibited by

moving to Florida since 1965 or being a member of the armed forces) discourages conventional home ownership but is conducive to mobile-home ownership.

Only observed family income proved significant in both versions, positively influencing home ownership but negatively influencing mobile-home ownership. That is, conventional home ownership probability varies directly with family income but mobile-home ownership probability varies inversely with family income. Generally, then, the same variables were statistically significant in the opposite direction.

The mobile-home ownership version of the model was also significant at the one-percent level, but had a smaller F statistic than the all-ownership version. R^2 for the mobile-home version was only .03, however.

Greater multicollinearity problems appeared with the mobile-home ownership version. Table 17 shows the linear correlation coefficients for the independent variables in this model. The most severe problems arise with respect to FAMINCOM and DSTUDENT. As one might expect, students are generally young and have low incomes. Family income is strongly related to student status, the family head's race, and the head being young. Of those findings which are significant, several stand out. A family headed by a person twenty-five years of age or less is 32 percent less likely to own its own home than a family headed by a person over

TABLE 17
Linear Correlation Matrix for Mobile Home Owner Tenure Model

	TENURE	DUMLE25	DUMGE65	DFEMHEAD	DFMSZLE2	DFMSZGE5	DHDNONWH
TENURE	1.00000	-0.05389	0.09270	-0.00129	0.06645	-0.05593	-0.11421
DUMLE25	-0.05389	1.00000	-0.25344	-0.14148	0.19840	-0.15153	0.47958
DUMGE65	0.09270	-0.25344	1.00000	0.18825	0.34854	-0.20658	-0.18232
DFEMHEAD	-0.00129	-0.14148	0.18825	1.00000	0.17559	-0.10076	-0.02499
DFMSZLE2	0.06645	0.19840	0.34854	0.17559	1.00000	-0.50059	0.09997
DFMSZGE5	-0.05593	-0.15153	-0.20658	-0.10076	-0.50059	1.00000	0.02268
DHDNONWH	-0.11421	0.47958	-0.18232	-0.02499	0.09997	0.02268	1.00000
DEDLTHS	0.01204	0.16246	0.11922	-0.01283	0.16038	-0.04780	0.36119
DEDSC	-0.03577	-0.07615	-0.06622	-0.02910	-0.07902	0.02109	-0.23360
DEDCG	-0.04363	-0.07870	-0.04264	-0.04314	-0.05584	0.02338	-0.15229
FAMINCOM	-0.09968	0.68859	-0.24068	-0.23049	0.20494	-0.09481	0.58242
DUMIGRAN	0.05590	-0.07388	0.00348	-0.05842	-0.02652	0.01022	-0.21011
DUMARMY	0.02175	0.06101	-0.07933	-0.06865	-0.07873	0.04421	-0.04779
DSTUDENT	-0.07552	0.71358	-0.20303	-0.15324	0.23613	-0.12938	0.55085
DMARRIED	-0.00745	0.15466	-0.20774	-0.77905	-0.25968	0.14738	0.03625

TABLE 1.7--Continued

	DEDLTHS	DEDSC	DEDCG	FAMINCOM	DUMARMY	DSTUDENT	DMARRIED
TENURE	0.01204	-0.03577	-0.04363	-0.09968	0.02175	-0.07552	-0.00745
DUMLE25	0.16246	-0.07615	-0.07870	0.68859	0.06101	0.71358	0.15466
DUMGE65	0.11922	-0.06622	-0.04264	-0.24068	-0.07933	-0.20303	-0.20774
DFEMHEAD	-0.01283	-0.02910	-0.04314	-0.23049	-0.06865	-0.15324	-0.77905
DFMSZLE2	0.16038	-0.07902	-0.05584	0.20494	-0.07873	0.23613	-0.25968
DFMSZGE5	-0.04780	0.02109	0.02338	-0.09481	0.04421	-0.12938	0.14738
DHDNONWH	0.36119	-0.23360	-0.15229	0.58542	-0.04779	0.55085	0.03625
DEDLTHS	1.00000	-0.56503	-0.36603	0.25349	-0.10679	0.23241	0.01051
DEDSC	-0.56503	1.00000	0.64782	-0.10930	0.04868	-0.05125	0.00975
DEDCG	-0.36603	0.64782	1.00000	-0.04464	0.02412	-0.04594	0.02504
FAMINCOM	0.25349	-0.10930	-0.04464	1.00000	-0.04923	0.83582	0.27087
DUMIGRAN	-0.14152	0.11885	0.09624	-0.17596	0.18440	-0.13882	0.03066
DUMARMY	-0.10679	0.04868	0.02412	-0.04923	1.00000	-0.02465	0.06742
DSTUDENT	0.23241	-0.05125	-0.04594	0.83582	-0.02465	1.00000	0.16602
DMARRIED	0.01051	0.00975	0.02504	0.27087	0.06742	0.16602	1.00000

twenty-five, but is 2 percent more likely to own a mobile home. A family recently moved to Florida is 22 percent less likely to own its home than a family which has been here more than five years. But recent movers are two percent more likely to own a mobile home than families who have lived here more than five years. Finally, the relationship between ownership and income is different for all owners and mobile-home owners. The relationship is positive in the all-ownership case, but negative for mobile-home ownership. This fact indicates that mobile-home housing is an inferior good--since many families who can afford to move out of mobile homes do.

Model Estimation: Model B

Model B, as described in Chapter IV, estimates the demand for mobile-home housing by regressing housing expense against a number of independent variables. Estimation of this model is done with data which were collected from families which had previously made the choice to live in a mobile home and were doing so in 1970. Model B is estimated using data for mobile-home owners and then reestimated for mobile-home renters. The model, in its most complete form, is

$$\log(\text{EXPENSE}) = b_0 + b_1 \log(\text{INCOME}) + b_2(\text{PRICE}) + b_3(\text{DUMLE25}) + b_4(\text{DUMGE65}) +$$

$$b_5(\text{DUMEDUCA}) + b_6(\text{NPERSON}) +$$
$$b_7(\text{DUMIGRAN}) + b_8(\text{DUMRACE}) +$$
$$b_9(\text{DUMHDSEX})$$

It would be very surprising, however, if all of these variables proved to be significant when the model was estimated. So the approach taken was not to try to force all of the independent variables into any one equation estimated. The demand equation for owners was estimated for each county group shown in Figure 4. The model for renters was run only for the state. Note that area 3103 contains not only nine Florida counties, but also seven counties in Georgia. Area 3501 contains four Florida counties and one from Alabama.

Model B Estimation for Mobile-Home Owners

The technique used for estimation is OLS regression. The most frequently used procedure for building a regression model is stepwise regression. This stepwise procedure may be "forward" or "backward." In the forward stepwise regression method, the model is expanded in discrete chunks--one or more independent variables being added at each step. The experimenter must specify the order in which variables are entered. Usually this is done on the basis of expected significance. The "best" independent variable is entered first and additional ones are entered in the order of, say,

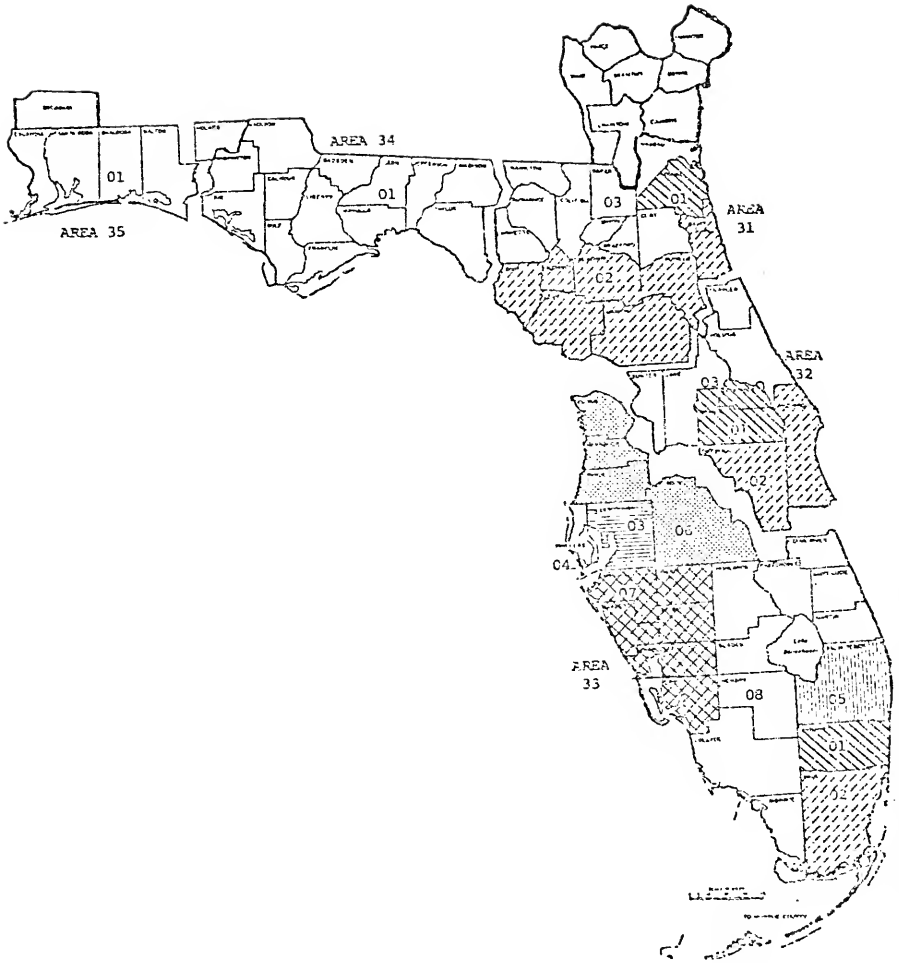

FIGURE 4
Public Use Sample Areas
and Subareas for Florida

decreasing F statistics. Once a variable is entered, it is "locked in" for subsequent estimations.

Besides the statistical problems of using this technique (Wonnacott and Wonnacott, 1970, pp. 309-311) there is no reason to believe that the "best" model of any independent variable size other than one will ever result from this stepwise technique. The interrelationships of the variables are sometimes such that the best model will not be obtained. Stepwise regression procedures may or may not yield the "best" model. This generalization applies also to the "backward" technique in which one starts with all independent variables present and drops them out in steps of one or more. There is no assurance of obtaining the "best" model with either the forward or backward stepwise technique of estimation.

For these reasons, stepwise regression was not the procedure followed in estimating the model developed here. A technique developed by James R. Goodnight entitled "Maximum R^2 Improvement" was utilized. This approach is described in A User's Guide to the Statistical Analysis System (Service, 1972, p. 128). Goodnight considers this technique

> superior to the stepwise technique and almost as good as calculating regressions on all possible subsets of the independent variables. [Unlike stepwise techniques] this technique does not settle on a single model. Instead it looks for the "best" one-variable model, the "best" two-variable model, and so forth. It

> finds first the one-variable model producing the highest R^2 statistic. Then another variable, the one which would yield the greatest increase in R^2, is added. Once this two-variable model is obtained, each of the variables in the model is compared to each variable not in the model. For each comparison the procedure determines if removing the variable in the model and replacing it with the presently excluded variable would increase R^2. After all the possible comparisons have been made, the switch which produces the largest increase in R^2 is made. Comparisons are made again, and the process continues until the procedure finds that no switch could increase R^2. (Service, 1972, p. 128)

Consequently, a variable entered on an earlier estimation is not locked in for subsequent estimations. It may or may not help produce the maximum R^2 for a larger model.

As mentioned, this technique was applied to each of the sixteen county groups for Florida. The model was enlarged up to the point at which the next variable added was not statistically significant at the ten-percent level. Variables were shuffled in and out subject to the constraint that only one income variable was allowed in at any stage of the process. A summary of the results of this regression technique is presented in Tables 18 and 19. These tables show the independent variables which met the statistical criteria for inclusion in each county group's model. The price variable showed up in every equation and the nature of the relationship is as expected in every instance. Mobile homes are (relatively) low-cost housing. As the disparity

TABLE 18
Variables Used in Model B Estimation for Mobile Home Owners

Area	Variables Contained in Best Model	Stage Where Income Entered First	Income Measure Entered	Income Elasticity When Entered First	Significant at 10% Level
3101	DUMGE65 PRICE	3	FAMINCOM	.096	No
3102	YPERMFAM PRICE	1	YPERMFAM	.397	Yes
3103	INCFAM DUMGE65 PRICE	2	INCFAM	.444	Yes
3201	NPERSON PRICE	3	FMINTR	.069	No
3202	PRICE FAMINCOM	1	FAMINCOM	.249	Yes
3203	PRICE NPERSON FAMINCOM DUMLE25	3	FAMINCOM	.151	Yes
3301	PRICE NPERSON DUMIGRAN	4	FMINTR	.079	No

TABLE 18--Continued

Area	Variables Contained in Best Model	Stage Where Income Entered First	Income Measure Entered	Income Elasticity When Entered First	Significant at 10% Level
3302	PRICE NPERSON FAMINCOM	2	FAMINCOM	.292	Yes
3303	PRICE DUMCE65 NPERSON FMINTR	3	FMINTR	.146	Yes
3304	PRICE NPERSON FMINTR	2	FMINTR	.152	Yes
3305	PRICE NPERSON INCFAM	3	INCFAM	.237	Yes
3306	PRICE DUMRACE DUMIGRAN FAMINCOM	2	FAMINCOM	.246	Yes
3307	PRICE DUMEDUCA NPERSON DUMLE25	5	FAMINCOM	.053	No

TABLE 18--Continued

Area	Variables Contained in Best Model	Stage Where Income Entered First	Income Measure Entered	Income Elasticity When Entered First	Significant at 10% Level
3308	PRICE FAMINCOM	1	FAMINCOM	.239	Yes
3401	PRICE DUMEDUCA FAMINCOM	2	FAMINCOM	.216	Yes
3501	PRICE DUMGE65 NPERSON DUMHDSEX	2	YPERMFAM	.434	No

TABLE 19
Coefficients Generated in Model B Estimation for Mobile Home Owners

	Constant	INCOME	PRICE	DUMLE25	DUMGE65	DUMEDUCA	NPERSON	DUMIGRAN	DUMRACE	DUMHDSEX	F	R^2
3101	3.9388		-2.6302		-0.3492						10.71	.296
			(9.05)		(12.36)							
3102	2.7092	0.3968	-3.7168								16.70	.350
		(22.59)	(10.81)									
3103	2.9090	0.4443	-4.5662		0.3957						8.01	.353
		(8.62)	(8.32)		(7.09)							
3201	4.3800		-4.5125				0.0500				24.67	.403
			(35.69)				(13.65)					
3202	2.8208	0.2487	-2.3120								13.09	.275
		(18.22)	(7.97)									
3203	3.3514	0.1507	-3.3505	-0.1595			0.0723				13.27	.399
		(4.11)	(14.93)	(3.06)			(30.99)					
3301	4.0276		-3.3398				0.0523	-0.1154			6.46	.205
			(10.27)				(4.66)	(4.45)				
3302	2.5706	0.2915	-2.6440				0.0549				17.01	.418
		(12.59)	(7.96)				(30.46)					
3303	3.7552	0.1458	-4.2640		0.1028		0.0427				12.55	.389
		(2.91)	(34.72)		(3.55)		(9.13)					
3304	3.6753	0.1515	-4.2114				0.0638				29.19	.317
		(18.54)	(61.29)				(7.47)					

TABLE 19--Continued

	Constant	INCOME	PRICE	DUMLE25	DUMGE65	DUMEDUCA	NPERSON	DUMIGRAN	DUMRACE	DUMHDSEX	F	R^2
3305	3.1466	0.2367 (6.33)	-3.5485 (14.08)				0.0516 (28.58)				16.33	.471
3306	3.2745	0.2464 (14.98)	-3.5090 (23.52)					-0.0787 (3.46)	-0.4141 (4.64)		11.65	.267
3307	4.1958		-4.0511 (66.67)	-0.1702 (4.61)		-0.0743 (6.32)	0.0750 (14.14)				22.94	.322
3308	3.2217	0.2391 (33.63)	-3.4469 (14.91)								24.27	.353
3401	3.4979	0.2161 (14.69)	-3.8553 (30.39)			-0.1053 (5.08)					16.72	.447
3501	4.4326		-4.4628 (30.23)		-0.2081 (6.64)		0.0345 (9.85)			-0.3607 (18.20)	16.23	.500

between the cost of conventional home ownership and mobile-home ownership increases, the mobile home looks more attractive.

Income appeared frequently as a significant predictor of expenditure, being present in eleven of the sixteen models. The value of the income coefficient ranged from 0.1458 to 0.4443, indicating, in all eleven cases, an income elasticity substantially below unity. Table 18 concentrates on the income variable--showing the first model in which an income variable appeared, the measure of income which appeared at that stage, and its coefficient.

The number of persons in the household is the only other independent variable which appeared with any regularity. It was significant in nine of the sixteen cases, and the relationship was positive in all instances. Table 19 shows actual coefficients, the F statistic for the final equation, and R^2 for that equation. Every variable appeared in at least one model. Five of the models included only two explanatory variables, five included four, and six included three variables. Explanatory power, as indicated by R^2, ranged from .205 in area 3301 to .500 for area 3501. The mean R^2 for all county groups is .360.

Since the housing expenditure-income relationship is of primary importance, a limited size version of Model B was estimated. The equation

$$\log(\text{EXPENSE}) = b_0 + b_1 \log(\text{INCOME})$$

was estimated for each county group with each measure of income. The results from these estimations are presented in Table 20. All coefficients are positive and in no instance is income elasticity greater than unity. In fact, the maximum coefficient for any measure of income for any area is below 0.5. This precise specification attempts to explain expenditure with only one independent variable--income. Such a formulation is "contrived," but has been used elsewhere in the housing literature.*

Estimation of a one-independent-variable model such as this one is a gross abstraction from reality. In this form, all variation in the dependent variable is attempted to be explained by variation in the one independent variable. Influences from all other sources are bundled up into one measure--in this case income. As additional explanatory variables are added to a model, the coefficient for this one variable may increase or decrease. So the value of the income coefficient in this smallest model should not be thought of as the maximum income elasticity.

Comparison between Table 18 and 20 may shed some light on the mobile-home housing expenditure-income relationship. Table 20 allows one to examine which measure of

*For example, Margaret Reid used this type of formulation in Housing and Income.

TABLE 20
Income Elasticities Generated
with Abbreviated Form of Model B

Area	YPERMFAM	FAMINCOM	INCFAM	FMINTR
3101	.141 (1.71)	.105 (1.98)	.041 (1.03)	.094 (1.61)
3102	.497 (19.64)	.379 (14.34)	.068 (1.53)	.376 (12.49)
3103	.186 (3.44)	.027 (0.58)	.072 (2.84)	.031 (0.73)
3201	.126 (5.42)	.111 (4.72)	.046 (1.19)	.130 (6.71)
3202	.000 (0.00)	.066 (2.09)	.085 (4.26)	.062 (1.81)
3203	.332 (13.74)	.271 (14.83)	.110 (8.27)	.237 (10.33)
3301	.158 (4.18)	.162 (8.28)	.068 (2.98)	.150 (7.13)
3302	.381 (16.86)	.448 (24.40)	.149 (8.61)	.425 (19.70)
3303	.291 (12.35)	.179 (6.72)	.075 (4.59)	.180 (6.43)
3304	.209 (12.99)	.210 (13.63)	.105 (11.03)	.170 (8.64)
3305	.405 (13.89)	.289 (12.34)	.164 (9.41)	.263 (9.40)
3306	.167 (14.05)	.191 (18.16)	.067 (5.42)	.181 (16.14)
3307	.249 (17.47)	.177 (14.65)	.110 (16.34)	.067 (2.91)
3308	.373 (17.91)	.316 (31.23)	.118 (11.27)	.184 (17.02)

TABLE 20--Continued

Area	YPERMFAM	FAMINCOM	INCFAM	FMINTR
3401	.358 (9.08)	.268 (13.41)	.058 (1.68)	.252 (11.63)
3501	.426 (14.52)	.175 (4.80)	.072 (3.11)	.032 (0.424)

income best predicts expenditure when only income is used as a predictor. Observed 1969 income works best for eight of the sixteen county groups. A measure of permanent income is selected in the other eight. Of these eight where a measure of permanent income performs best, in six of the country groups the purest measure of permanent income is selected. Permanent income measures which take account of actual family experience are selected in only two instances.

Table 18, which shows variables as they were selected and included on the basis of constructing the "best" model, also shows that observed 1969 family income should be selected in eight of the 16 county groups and that a measure of permanent income should be used in the other eight. A point to be noted, however, is that in five of the "best" equations income was not included as an explanatory variable. In the eleven county group models where income is used as an independent variable, a permanent income measure of income is selected in five instances and observed 1969 income is selected in the other six. It appears that permanent income explains more variation in expenditure when income is the only independent variable used. When other (primarily demographic) variables are used to help explain variation in expenditure, observed income performs better in about half the cases. The implication seems to be that the explicit variables which measure demographic character-

istics explain most of what permanent income embodies that observed income does not--that is, a concept of income viewed in a long-term sense so that the influence of random year-to-year variations is minimized appears to explain variation that individual demographic variables also explain.

Model B Estimation for Mobile-Home Renters

Model B was also estimated for Florida's mobile-home renters. Because there were so few observations, however, estimation was not attempted for each county group. Model specification is exactly the same as for mobile home owners, except that the housing expense variable is annual contract rent. The results of this model's estimation are presented in Table 21. This model, estimated for the entire state, uses annual contract rent as the housing expense measure. Estimated separately with a different measure of income as the independent variable each time, the overall results were disappointing. For all but the purest measure of permanent income, income, when entered, was not statistically significant as an independent variable. When income was entered, the observed elasticity was very low, ranging from .004 for LGFMINTR to .240 for LGYPERMF. This model was also modified so that only income was used as a predictor of rental mobile-home housing expense. These results are presented in the final column of Table 21.

TABLE 21
Model B Estimation for Florida Mobile Home Renters

Income Variable Used	Step on Which First Entered	Income Elasticity	Maximum Income Elasticity	Significant at 5%	Variables in Best Equation	Computed Coefficient	F Statistic for "Best" Equation	Income Elasticity When Income Used as Only Independent Variable
FAMINCOM	5	.039 (0.75)	.039	No	DUMGE65	-0.213 (3.23)	10.46	.068 (1.30)
YPERMFAM	1	.240 (4.33)	.337	Yes	YPERMFAM	0.337 (4.33)	11.74	.240 (4.33)
					PRICE	-3.453 (2.84)		
					DUMHDSEX	0.210 (2.69)		
FMINTR	7	.005 (0.13)	.006 (0.15)	No	DUMGE65	-0.213 (3.23)	10.46	.014 (0.36)
INCFAM	3	.095 (1.43)	.147	No	DUMGE65	-0.213 (3.23)	10.46	.150 (2.52)

Comparison of these results from the rental-housing model with the results from the owner-occupied model suggests that rental expenditures are less sensitive to income changes than are owners' expenditures. This is indicated by the generally lower income elasticities for renters. There are some differences between the two which may make direct comparisons difficult, however. The primary difference is that mobile home expense for owners does not include any payment for site value. Contract rent (expense for renters) does include an element of site value, however. In an attempt to make these sectors more comparable, the renter model was reestimated with the dependent variable measured in a manner to exclude that part of contract rent which was payment for site value. The renter version of Model B was reestimated using as the dependent variable, not contract rent, but 75 percent of contract rent. The assumption embodied in this formulation is that one-fourth of the contract rent is payment for site value. Additionally, it was hoped that there might be enough observations so that the state could be broken down into at least two geographic regions. These regions are North Florida (areas 31, 32, 34, 35) and South Florida (area 33). These two broad areas contain seventy-nine and ninety-two household observations, respectively. The renter model was reestimated incorporating these modifications with some

slight improvement in results. Table 22 shows these results. Only when explaining rental expense for South Florida does any measure of income appear in the best model. YPERMFAM, the measure of pure permanent income used in this study, shows up in the model and has an income elasticity of .25.

Overall, Model B, when estimated for renters is not very satisfying. In some cases rental housing is hardly responsive to changes in income at all. The basic model, which operates fairly well for owners' expenditures, predicts rental expenditure less accurately. Even though there is considerable variability among the characteristics of the mobile-home renters, there is less variability in contract rent payments. In North Florida no measure of income used is a relaible predictor of rental expenditure. In South Florida, only YPERMFAM is found to be statistically significant when entered into the model. Income elasticities are less for renters than for owners, and also less statistically significant. In some instances rental expenditure is almost totally unrelated to any measure of income. This situation is probably indicative of the fact that renting mobile-home housing is a temporary situation. The findings here are too much at odds with conventional theory and logical reasoning to be considered of permanent significance.

TABLE 22
Model B Estimation for North and South Florida Mobile Home Renters

North Florida

Income Variable Used	Step on Which First Entered	Income Elasticity	Maximum Income Elasticity	Significant at 5%	Variables in Best Equation	Computed Coefficient	F Statistic
FAMINCOM	9	.041 (0.71)	.041	No	DUMGE65	-0.277 (2.57)	7.00
					DEDLTHS	-0.092 (2.57)	
YPERMFAM	7	.167 (1.26)	.229	No	DUMGE65	-0.277 (2.57)	7.00
					DEDLTHS	-0.092 (2.57)	
PMINTR	9	.016 (0.50)	.016	No	DUMGE65	-0.277 (2.57)	7.00
					DEDLTHS	-0.092 (2.57)	
INCFAM	9	.066 (0.49)	.066	No	DUMGE65	-0.277 (2.57)	7.00
					DEDLTHS	-0.092 (2.57)	

TABLE 22--Continued

South Florida

Income Variable Used	Step on Which First Entered	Income Elasticity	Maximum Income Elasticity	Significant at 5%	Variables in Best Equation	Computed Coefficient	F Statistic
FAMINCOM	4	.052 (0.69)	.069	No	PRICE	-3.708 (2.05)	4.20
YPERMFAM	1	.254 (3.25)	.335	Yes	YPERMFAM	.247 (3.21)	7.45
					PRICE	-3.461 (2.01)	
FMINTR	7	.019 (0.27)	.020	No	PRICE	-3.708 (2.05)	4.20
INCFAM	2	.140 (1.67)	.176	Yes	PRICE	-3.708 (2.05)	4.20

CHAPTER VI
SUMMARY AND CONCLUSIONS

Scope of Research

This research has sought to do several things in analyzing mobile-home usage in Florida. First the "big picture" was investigated: What is the extent of usage? Who are the users of this form of housing? Are there distinguishing characteristics of mobile-home dwellers? Following this descriptive inquiry, several models were developed and estimated using cross-section data to explain and predict mobile-home usage. Owners and renters were examined separately, and particular attention was given to the housing expenditure-income relationship for both owners and renters. Different concepts of income were utilized so that the model's sensitivity to the definition of income could be observed. Income elasticity of demand received special attention to determine whether mobile homes are a normal or inferior good.

This research fills a gap in the existing literature. On the one hand, the type of empirical investigation performed here is similar to that carried out for conventional housing in the academic literature. Almost

without exception, empirical modeling has not been applied to mobile-home housing--an increasing proportion of our housing stock. This investigation bridges the gap between the academic literature on conventional housing and the "trade" literature on mobile homes, which has been almost entirely descriptive rather than analytical.

Specific Findings: Descriptive

Among work which has been published, other researchers working with mobile-home data have assumed or concluded:

1. That once a family has decided which sector of the market to enter (i.e., to own or rent), the price of housing in the other sector becomes irrelevant to the family's decision process (Ohls, 1971, p. 9).
2. That "mobile-home demand is directly competitive with conventional single-family housing starts as opposed to being directly competitive with multiple-family starts" (Davidson, 1973, p. 159).
3. That heads of mobile-home households are generally younger than heads of other types of households (Davidson, 1973, p. 134).
4. That younger households who have not yet achieved higher income levels are the primary

purchasers of mobile homes (Davidson, 1973, p. 118).

5. That mobile-home livers are a homogeneous group: young, starter couples, blue collar, average education. Median incomes have been found to be low--$6,620 for mobile-home owners compared to $7,500 for new apartment renters and $8,000 for new home owners (Mobile Home Market, p. 25).

The findings from this study of Florida's mobile-home occupants are different from most of these just cited. These previously published findings were based on national averages, and while not being challenged here, may not be representative of data from particular regions. The average of California and Maine mobile-home families may be descriptively false of both subgroups. Florida data are, in fact, somewhat different from the above "average" findings. For instance, the tenure decision appears to be a secondary consideration for many families. The income constraint seems to be of primary importance, with other decisions (to own or rent a mobile home) following the budgetary allocation for housing. Conventional single-family home ownership cannot compete with mobile-home housing on the basis of price.

The characteristics of mobile-home owners are in some respects (age, family size, and mobility) like renters and in some respects like owners (race, education, and sex of family head). As far as housing expenditure is concerned, however, mobile-home ownership is much more in line with the cost of renting rather than with that of conventional ownership. Additionally, Florida has a high percentage of older people among its population, and these people make extensive use of mobile-home housing. Nationally it is not true that those states with a relatively high percentage of older people make heavy use of mobile-home housing. So there are different factors which lead to mobile-home attractiveness, and Florida seems to combine many of these factors which are favorable to this type of housing choice.

It is not true that Florida's mobile-home owners are a homogeneous group, though. They are homogeneous only with respect to racial composition, as will be discussed later. They are relatively young in the "young" parts of the state (areas 31, 34, and 35), but they are older than the "all owner" or "all renter" categories in south Florida. Their incomes are below the "all-owner" group's, but in some instances, higher than the "all-renter" group's. Their educational attainment is, again, between the other two groups. Household size for mobile-home owners is generally small.

For mobile-home-renter households, it was observed that, compared with mobile-home owners, they are more mobile, younger, have lower incomes, and are more often headed by a female. This combination of factors suggests that renting a mobile home is temporary, as opposed to permanent, housing.

These points summarize the comparison with other housing groups, but within the mobile-home-owner group, there is also wide variation. Among the county groups the variation found in Tables 5, 6, 7 and 8 is summarized in Table 23.

TABLE 23
Percentage Variation in Descriptive Data

	Owners		Renters	
	All	Mobile-Home	All	Mobile-Home
Male-Headed Family	12.3	24.3	13.6	23.7
Mobility	26.5	57.0	44.3	976.0
Age of Head	28.6	83.2	30.5	89.1
Household Size	34.1	72.0	18.8	43.4

The numbers represent the percent variation between the high and low observations. For mobile-home owners the mean age of the head is lowest in area 3401 (36.01 years) and the highest in area 3304 (65.98 years). The variation (29.97) is 83.2 percent of the lowest observation (36.01). The

mobile-home owners are certainly not a homogeneous group. In the retirement areas (3304, 3307), they are generally white, mobile, not as often headed by a male, older, have lower incomes, and smaller household size. In the least rural areas (3101, 3201, 3301, 3302, 3303, 3305) there is a good deal of variation in most of the characteristics and in the most rural areas (3308, 3401, 3501) there seems to be the most homogeneity among each subgroup.

Specific Findings: Analytical

A model to predict the probability of home ownership was developed. The model was estimated for all owners and then reestimated to predict the probability of mobile-home ownership. This model was called a tenure model since the dependent variable deals with ownership probability. The model was used to demonstrate that many of the variables which are significant for estimating the probability of home ownership are also significant for estimating the probability of mobile-home ownership. Quite often, however, it was noted that the sign of the estimated coefficient was different between the "all-ownership" and the "mobile-home-ownership" versions of the tenure model. For instance, the coefficient of the variable DUMIGRAN was -0.22177 when estimated in the "all-owners" version of the tenure model, but +0.01632 when estimated in the "mobile-home-ownership"

version (see Table 15). DUMIGRAN is the dummy variable which takes on a value of one if the family had moved into the state in the last five years before the survey, but remains zero otherwise. The positive coefficient in the "mobile-home-ownership" version indicates an increased probability of mobile-home ownership if the family had recently moved while the negative coefficient in the "all-ownership" version indicates that having recently moved decreases the probability of ownership in general. Coefficient sign changes such as this between the two models were observed frequently. As observed income increased, the probability of ownership also increased (positive coefficient), but the probability of mobile-home ownership decreased (negative income coefficient). Based on this negative income coefficient, the income elasticity of demand for mobile homes would also be negative and mobile home housing would therefore be an inferior good.

Model B, a more traditional regression model, explains mobile-home expenditure from other (independent) variables. This model was estimated for each county group for mobile-home owners and for north and south Florida for renters of mobile homes.

The owners version of the expense model performed better than the renters model. Even in the owners version, however, demographic variables, other than household size,

showed up with little regularity. Income, price, and family size were responsible for most of the explanatory power generated. Other variables, selected on grounds of statistical significance, were included only in one or two instances. For example, DUMRACE appears only in the "best" equation for area 3306. The measure of income which was selected on statistical grounds did not appear to follow any geographical pattern. Permanent income worked well in areas 3102, 3303, and 3501--some of the most rural areas. Observed income performed well in 3301 (urban) and 3308 (rural and urban) and 3306 (rural).

Income elasticities turned out to be low in every area with every measure of income tried. They ranged from almost zero to +0.5. Permanent income usually yielded the highest income elasticity, but not necessarily the most significant. This phenomenon can be observed in Table 20. Pure permanent income (YPERMFAM) exhibits the highest coefficient in eleven of the sixteen county groups, but has the highest "t" statistic in only six. In no instance was income elasticity found to be negative.

The renters version of the expense model proved to be only marginally acceptable. The pure measure of permanent income (YPERMFAM) again generated the highest income elasticities, but in this case they were also the most sig-

nificant statistically. (Higher coefficients are not necessarily more significant than lower ones.) One difficulty in analyzing the renters of mobile homes is in selecting the appropriate income measure. If renting is a temporary solution to one's housing needs, a short-term measure of income might be preferable. To the extent that temporary and permanent renters are intermingled, no measure of income may perform very well.

When one integrates the findings of the two models he finds some additional information. Within the population of mobile-home owners there is a positive relationship between monthly housing expense and income. But as income increases, there is a decreasing probability of mobile-home ownership. As it turns out, when we look at mobile-home families we are usually looking at a relatively low-income subgroup in the income spectrum. If their incomes rise they are likely to make a switch to conventional home ownership, especially if they are not in the retiree's age range.

Even though we find that mobile home occupants are relatively low-income households and that nonwhite households are relatively low-income households, there are very few nonwhite families which own their own mobile home or rent someone else's. There is very little information in the census data to explain this paradoxical fact. The reason for such little use by nonwhites is, at this point,

a matter of speculation. Perhaps exclusion in the credit market is the explanation. It may be that nonwhites cannot qualify for financing. But it may be that so little use of mobile homes by nonwhites is simply a matter of tastes. Perhaps nonwhites do not care for the alternative offered by a mobile home. In considering this line of reasoning one might ask "Where can a mobile home occupied by a nonwhite be located in an urban area?" Discrimination may be a factor in this connection, but whether it is or not, mobile homes are not usually located in central cities where nonwhites are often located. Mobile homes are located in suburban and rural areas. In most urban areas their use is limited by zoning restrictions. It seems possible that the spatial location of mobile housing may be responsible for the low utilization of mobile homes by nonwhites.

As shown by Model B, up to 50 percent of the variation in mobile-home housing expenditure can be explained. The least explained variation is in area 3301 (Broward County), and the model performs best in the western part of the state. Income is the single best predictor of expenditure in only three areas, but appears in eleven "best" equations. Price appears in all area models--showing, as one might guess, that the primary attractiveness of mobile homes is the relative cost advantage. They are not only less expensive to build because of being

smaller than conventional structures, but are also less expensive per square foot of shelter space. And this advantage has strengthened over the last two decades.

There is no credit market term in either of the models developed here. This is not simply an oversight, but is the result of several relevant considerations. The first one is the difficulty of locating data. No questions on financing were included in the Public Use Sample. Secondly, it is suspected that differences in credit terms across the state would be small, even if available. Before 1970 mobile homes were financed much like automobiles and the term of financing did not exceed seven years. Thirdly, a high proportion of mobile homes are purchased without financing. Therefore, the cost of credit is not included as a housing cost in this study. Although unsubstantiated at this point, it is conceivable that there could be a positive correlation between mortgage rates and the demand for mobile homes. As the cost of financing a house rises, some potential buyers could shift away from the increased cost of ownership. While mobile-home financing is likely to have gone up at the same time, the amount to be financed would be substantially less. So even with a high rate of interest payable on a mobile home loan, the dollar amount of the monthly obligation would still be only a fraction of that for a conventional mortgage. The total effect on

the mobile-home market of this financing cost differential would be the net result of the two offsetting effects--analogous to the income and substitution effects of micro-economic theory.

The price variable used in this study is actually a relative price variable which takes into account the average price of a mobile home and the average cost of a new conventional house. As the cost of a conventional house rises relative to that of a mobile home, the value of the price variable falls. That is to say, the mobile home becomes a more attractive alternative as its relative price decreases. Ideally a price variable for each area of the state would be desirable, but here again, availability of reliable data proved to be a problem. At any rate, the nature of cross-sectional data is such that the study of price effects is extremely difficult. Besides the often-present lack of sufficient variation in prices, it is extremely difficult to abstract from quality variation. The assumptions necessary for dealing with these factors in order to derive price elasticities are heroic. Other researchers have had similar difficulties in analyzing conventional housing. For these reasons, even though a price variable was used in the expense model, price elasticity was not estimated.

Another variable which would seem to be appropriate in predicting mobile-home demand is the vacancy rate found

in other housing market sectors. If vacancy rates are high and rental rates are downwardly flexible, the demand for mobile homes should be reduced. In this case the relative cost advantage of a mobile home would be lessened. But, as with the other variables just mentioned, the data needed are simply not available. Postal service vacancy surveys are performed periodically in various locations, but these are of little use except in specific local situations.

Local zoning ordinances are also influential with respect to demand and location of mobile homes. Mobile-home parks do not usually win great favor with city or county zoning boards.* There is no reliable study known which has estimated the (restrictive) influence on mobile home demand of local zoning ordinances. There are, however, known cases of governmental hostility to existence of mobile-home parks.* If there is not a suitable location for one's mobile home, one might not buy a mobile home. To the extent that zoning boards or planning commissions are made up of contractors or real estate brokers, antagonism might be expected toward mobile-home park development.

Choice of the appropriate income concept is not settled. The issue "cannot be settled by economic theory

*Conversation with official of Florida Mobilehome and Recreational Vehicle Association, March 19, 1976.

alone" (Houthakker and Taylor, 1970, p. 225). Depending on what it is one wishes to study, the definition of income may vary. Since permanent income is not directly observable, there may be as many measures of it as there are researchers. The concepts used in this study were constructed to coincide with the housing choice being investigated. The measures used here might be inappropriate to study the demand for television sets or conventional houses, though, since the life expectancy of these items would probably be different from that of a mobile home. The best measure of income is not one that coincides with some preconceived idea of what is relevant or with what one "ought" to find in his study. The measure of income which best "explains" mobile-home housing expenditure is the one which performs "best" on the basis of objective, statistical grounds. It was found in the course of this research that no blanket statement regarding the preferability of some measure of permanent income over another or even of the preferability of permanent income over observed income could be made. It was generally found, however, that a measure of permanent income would usually generate a higher income elasticity of demand than would observed income.

Implications and Unanswered Questions

While Florida cannot be thought of as being representative of the United States, it does provide us with an area where extensive use of mobile-home housing is being made. There are other such areas. California contains more mobile homes than does Florida. Other states have a greater proportion of the total mobile-home stock than of the national population (Arizona, North Carolina, Georgia, Alabama and Indiana are only a few). As the relative cost of conventional housing rises (not to mention site values), an increasing segment of our population might find the mobile home a more palatable alternative. It seems that the crucial question in this regard is whether real incomes or housing costs will rise faster.

The desirable aspects of mobile-home housing which lead to its adoption as one's housing choice are present in places other than Florida. These aspects were mentioned in Chapter III and include low price, low maintenance cost, single-family ownership, flexibility in environmental choice, and the well-developed market for used units. Florida also has appeal because of its mild climate (except for the possibility of hurricanes), but so do other geographical areas of the United States. As the birth rate has fallen in recent years and families are getting smaller,

there will be less need for large homes. This influence should be encouraging to the mobile-home sector of the housing market as opposed to the single-family conventional structure. The rising cost of energy (for heating and cooling) should also make smaller homes in general, and mobile homes in particular, relatively more attractive in the future.

While the ownership expense version of Model B performed acceptably well, the renter version was less satisfying in its performance. It appears that further study in this area would be desirable in developing a better performing model of mobile-home rental behavior. It may be that these renters are such a heterogeneous group that this task would be difficult.

As far as mobile-home ownership is concerned, this study indicates that time might be profitably spent in several areas. For instance, why, in fact, do nonwhites make such minimal use of mobile homes? Might increased use be a partial solution to the housing problems of low-income minorities who live in the cities? If so, what policy implications follow?

No single measure of income appeared as a superior predictor of mobile-home expense. No determining principle as to which income measure performed best under what circumstances was found, though. Further inquiry into this

question may be needed. It may be that some measure of income not employed in this research would, in fact, predict better than those used here. For instance, asset holdings should perhaps go into such a formulation. This would allow a researcher to tie permanent income more closely to wealth.

Finally, price considerations are deserving of further study. Price elasticity of demand for mobile homes is, at this point, a matter of speculation. Although a price variable was employed in this research, further work with better price data is needed. It is possible that future use of mobile homes will be as much determined by price elasticity as by income elasticity. It may also be possible to incorporate the significance of product quality changes over time through use of good price data.

It appears that mobile homes fill a growing need in the housing market. There is no other form of housing currently available which can provide decent shelter space at a carrying cost competitive with a mobile home. "For many moderate-income American families, the mobile home is the only kind of housing they can reasonable afford."* Mobile homes are low-cost housing, but they are

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*Message from the President of the United States transmitting the Second Annual Report on National Housing Goals, Committee on Banking and Currency (Washington: U.S. Government Printing Office, April 1, 1970).

utilized by families which are not necessarily low-income families. The growth of mobile home utilization reflects two basic attitudes--one new and one old. First, mobile-home living reflects a desire for a less traditional dwelling unit whose environment is flexible. Second, the mobile home choice reflects something the consumer is continuously shopping for--a good buy--decent housing at an affordable price. The mobile home will probably never replace the conventional single-family structure or the apartment building, but it should continue to attract those who prefer ownership to renting and those who cannot or do not wish to spend a high percentage of their incomes on housing.

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BIOGRAPHICAL SKETCH

Max Holt Strader, Jr., was born in Winston-Salem, North Carolina, on January 19, 1945. He attended Calvin H. Wiley grammar school and graduated from R. J. Reynolds High School in 1963. In September 1963 he entered North Carolina State University. In September of 1966 he was married to the former Sonya King Thompson, also from Winston-Salem. In May of 1967 he received a B.A. degree as a Liberal Arts major in Economics. Following graduation the Straders moved to Gainesville, Florida, where Max was enrolled in the graduate program in economics and Sonya was employed as a secretary in the University Personnel Department. In August of 1969 two important things took place: Max accepted Jesus Christ as his personal savior. Second, he was awarded a Master of Arts degree in Economics. His thesis was entitled "Malthusianism and the Development of Economic Thought." In October 1969, Max began his tour of active duty as a second lieutenant with the U.S. Army at Fort Benning, Georgia. The following February he and Sonya traveled to Anchorage, Alaska, where Max spent his final eighteen months on active duty. He taught an economics course for the University of Alaska-Anchorage while stationed there.

In the fall of 1971 it was back to North Carolina where Max spent one year in the graduate program at the University of North Carolina-Chapel Hill. August of 1972 found the Straders moving back to Gainesville, Florida, where Max reentered the University of Florida. In the midst of qualifying exams in November of 1974 their son, Gary Preston Strader, was born. In August of 1976 Max accepted a faculty position at Missouri Western State College in St. Joseph, Missouri, as Assistant Professor of Economics. He finished the writing of his dissertation and was awarded the Doctor of Philosophy degree by the University of Florida in the summer of 1977.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Jerome W. Milliman, Chairman
Professor of Economics

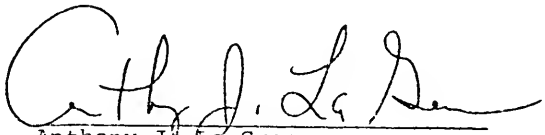
I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Madelyn Lockhart
Professor of Economics

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Frederick C. Goddard
Associate Professor of
Economics

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.



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This dissertation was submitted to the Graduate Faculty of the Department of Economics in the College of Business Administration and to the Graduate Council, and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

August 1977

Dean, Graduate School