Employment Access, Residential Location and Homeownership

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Introduction

Large racial differences in home ownership have been a source of considerable concern among policymakers because homeownership choice may influence wealth accumulation, labor market outcomes, and even children's educational outcomes. Racial differences in ownership rates may be affected by discrimination (Kain and Quigley, 1972), and extensive literatures examine real estate broker and mortgage lender treatment of minorities, see for example Yinger (1992) and Munnell et. al. (1996). In a direct examination of the ownership choice, Linneman and Wachter (1989) find no significant racial differences in ownership among households who are not wealth constrained in terms of standard downpayment requirements, but Gyourko, Linneman, and Wachter (1997a) find that among constrained households whites are more likely to own than equivalent minorities.

In most American metropolitan areas, many minorities are segregated into central cities, and the literature of racial segregation demonstrates that the level of observed segregation cannot be explained by income differences (Kain, 1976, 1992; Massey and Denton, 1993). Similarly, the homeownership decision may be driven in part an individual's location choice. In fact, Gyourko, Linneman, and Wachter (1997b) find that even unconstrained minorities disproportionately own in central cities. This spatial pattern of ownership may discourage prospective minority homeowners because central city neighborhoods may face greater equity risk or have negative attributes that limit the value of homeownership.

More generally, the empirical literature has demonstrated that minorities have lower homeownership rates, have less access to public amenities, and are more subject to a spatial employment mismatch, even conditional on economic endowments. To isolate some of the

factors that contribute to these disparate outcomes, we estimate an empirical choice model of homeownership and residential location that accounts for access to the household members' employment locations. Specifically, this study examines the relationship between the decision to own a home and the household's residential location choice. Furthermore, this study tests the premise that the spatial pattern of employment influences residential location decisions, which in turn may have an influence on homeownership.

This hypothesis is indirectly related to the traditional spatial mismatch hypothesis. The spatial mismatch hypothesis is based on the notion that racial residential segregation limits minority access to employment opportunities. The evidence that location matters in employment outcomes continues to mount, but the mechanisms by which location influences employment are not well understood. Ihlanfeldt (1993, 1994) finds that physical access to jobs directly affects the likelihood and quality of employment in separate studies of New York City and Atlanta. O'Regan and Quigley (1996) find that neighborhood characteristics, rather than job access, influences the likelihood of youth employment for four MSAs in New Jersey. Alternatively, Ross (1998) in a study of residential and job mobility finds that African-America housing market opportunities influence employment outcomes, rather than actual residential location. Glaeser (1996) argues that all of these studies suffer from the same problem. Residential location choice is imbedded in a set of interrelated choices that include household member's labor market, as well as choices in the housing market.

Alternatively, this paper suggests that the spatial pattern of employment may influence residential location decisions, which in turn have a large influence on the decision to purchase one's residence. In light of Glaeser's concerns, this reversal appears reasonable. Households care

about commuting time and job access, and the residential location is likely to be influenced by these factors. Moreover, the benefits and risks of owning a home are clearly related to the location of the housing unit and the attributes of that location. It may be difficult, however, to distinguish between the influence of location on ownership and the potential simultaneity between ownership and location choice. The influence of employment access on residential location provides a reasonable lever for untangling this simultaneity.

Note that the initial version of this paper focuses on the 1985 sample of the American Housing Survey for the Philadelphia MSA. This study uses the 1985 version of the AHS because employment location is only available for the 1984 and 1985 samples. Other variables in the analysis are constructed using the 1990 Census Transportation Planning Package. The CTPP only provides information at the Census Tract level for a few metropolitan areas, which includes Philadelphia. We plan to extend the paper to other metropolitan areas, such as Los Angeles, where the CTPP also provides information at the census tract level. Furthermore, the employment location of individual household members is treated as exogenous. Our eventual goal is to develop a model which includes three choices: employment location, residential location, and homeownership.

Methodology

Tenure Choice Specification

The Household tenure choice specification follows standard approaches in the literature. The tenure choice model is part of a simultaneous system involving the employment and earnings of family members, family non-labor income, family liquid assets, housing equity, and housing demand. Reduced form models of the other outcomes are estimated and used to create a

prediction of total family income, as well as a constraint variable for each household based on predicted housing consumption and predicted liquid assets. The tenure choice equation also depends on household structure, family member characteristics, and the characteristics of the household residential location, such as percent of households in poverty, percent owner-occupied units, and relative housing costs.

Family income is predicted using a single equation for non-labor earnings and a two stage process for labor earnings. First, an employment equation is estimated for each adult family member where employment depends on individual characteristics, family structure, and residential location fixed effects. For employed family members, labor earnings are estimated as a function of individual characteristics, family structure, and employment location fixed effects, and the estimation is corrected for sample selection bias. Labor earnings are predicted for each family member and weighted by the probability of employment. Non-labor income is estimated as a function of both family characteristics and residential location, and predicted for each household. Note predicted values do not depend on either work or residential location because they are based on the sample average of the estimated location fixed effects.

A constraint dummy variable is created based on whether the family's predicted assets available for home purchase exceed a set fraction of the predicted optimal house value. Unconstrained households are defined as households that had at least a 20 percent equity in their home at the time of purchase. Using this sample, house value at the time of purchase is estimated as a function of family characteristics, residential location, and years since the purchase. Predicted optimal house value is based on the resulting parameter estimates and the assumption that the number of years since the purchase equals zero, see Goodman and Kawai

(1982) for an earlier example of this approach. Predicted assets must equal 23 percent of predicted optimal house value in order to allow for a 20 percent downpayment, as well as closing costs and possible points.

Predicted assets are the sum of predicted housing equity and predicted liquid assets. Housing equity is estimated as a function of family characteristics while correcting for sample selection into homeownership, which is a function of both family characteristics and residential location. Housing equity is predicted for the entire sample of households using the model parameter estimates, and the predicted equity times the probability of homeownership is used as an instrument for housing wealth. The non-labor income estimation discussed earlier depends on variables that describe sources of non-labor income. Predicted income from liquid assets is based on the estimated non-labor income model under the assumption that the only sources of income are dividends and interest income. Predicted liquid assets for the entire sample are the predicted non-labor income from dividends or interest times the probability of having income from dividends or interest divided by 0.03, 0.05 or 0.07 representing alternative rates of return that might be earned on these assets.

Relative housing costs are constructed by estimating separate hedonic models of housing price for owners and monthly rent for renters. First, a reduced form housing tenure choice model is estimated depending on family characteristics and residential location. The estimates from the reduced form tenure choice model are used to calculate sample selection terms for the hedonic models. The hedonic models include the physical characteristics of the owner occupied or rental property, as well as residential location fixed effects. The relative cost of housing is the difference between the housing price and the rent fixed effects.

A Multinomial Model of Tenure and Residential Location Choice

The choice model is specified as a nested multinomial logit over both the residential location and the tenure choices. In the nested multinomial logit, a hierarchy of choices is established, but at each choice level an individual has full information on all opportunities that are available at the lower level choices. Tenure choice is specified as the highest level choice, and residential location is lower level choice. As a result, the empirical model provides a fairly complete description of the choice process including how residential location choice may directly and indirectly shape the decision to own a home. This model can then be used to isolate the many different factors that might contribute to racial differences in homeownership and residential location patterns.

The nested multinomial logit is estimated in two stages. First the residential location model, the lower level choice, is estimated as a multinomial logit conditional on tenure choice. The residential location choice model depends both on individual characteristics and location attributes. The residential location attributes include both characteristics of each location, which do not vary by individual, and well as employment location access variables, which depend on the employment locations of the head of household and spouse if married. The coefficients on the location attributes are constant across all choices and illustrate the relationship between an attribute and the attractiveness of a given location. The location choice specification also involves a separate model for each possible location including whether the head of household is employed, if employed whether the head of household's employment location is known, and similar variables for the head's spouse if married.

The second stage estimation involves the tenure choice. The results of the first stage

estimation are used to generate an inclusive value (Maddala, 1985, p. 68) for each family in the sample. The inclusive value represents the value of ownership relative to renting across all residential location options. The inclusive value is included as a regressor in the tenure choice model discussed earlier and controls for the influence of residential location choice on the tenure choice.

Data Description

The base sample for this analysis is the 1985 Metropolitan Area (Metro) sample of the American Housing Survey (AHS) for Philadelphia. The Metro sample of the AHS contains detailed housing characteristics and the location of the housing unit down to zones of approximately 100,000 in population. The city of Philadelphia is divided into 13 zones, and the rest of the metropolitan area is divided into 22 additional zones. It also contains information on family structure, family member demographics, and limited labor market variables for each member. The 1985 survey also included a commuting subsection in the survey, which collected the employment location of every employed family member using the same spatial zones that were used to record residential location.

The tenure choice model is estimated using a sample of families from the American Housing Survey. The family variables are constructed from the perspective of a reference individual, e.g. the individual filling out the survey. The model specification includes characteristics of the reference person, characteristics of the reference person's spouse if married, whether the household includes relatives of the reference person, number of individuals in the household by age, the sources of household non-labor family income, and availability of vehicles for commuting.

As described earlier, the constraint variable is based on predicted optimal housing demand and predicted housing equity. Housing equity is calculated based on reported house value for homeowners with no mortgage or with a fixed rate mortgage since the AHS contains interest rates, year of the home purchase, and original mortgage amount. Optimal housing demand is estimated using the purchase price of the housing unit for every homeowner who purchased their home with at least a 20 percent downpayment. Both the housing demand and home equity specifications include the same family variables as the tenure choice equation.

Predicted family income is constructed using the family non-labor income variable, the labor earnings for each family member over age 16, and whether the family member is employed at the time of the survey. The non-labor income specification also uses the same family variables as the tenure choice model. All family members over the age of 16 are included in the employment equation. The earnings equation is estimated for every member who reports being employed at the time of the survey. Both the employment and the labor earnings specification includes many individual characteristics including age with separate intercepts and slopes for each of the following age categories: 16-18, 19-22, 23-55, 55-65, and 65 and older. The specifications also depend on the presence of other family members for the reference person and the relationship to the reference person for all other family members.

As discussed earlier, relative housing costs are based on the fixed effect estimates from the housing price and monthly rent hedonics. The specification of the reduced form tenure choice equation includes the same family characteristics as the final tenure choice equation. The both hedonic specifications include number of square feet, number of each type of room, ages, whether unit contains specific features like a garage, porch or fireplace, type of unit, and if a

rental property whether utilities are included in the rent.

The Department of Housing and Urban Development provided a list of 1980 census tracts that comprise each of the Metro sample zones, and this list was modified to account for changes in the census tract definitions between 1980 and 1990. Using this list and the Basic Summary Table Files (STF3) from the 1990 U.S. census, the following variables are generated for each Metro sample zones: percent owner occupied residences, percent residents in poverty, percent hispanic households, and percent African-American households. For all variables in the tenure choice model, the names, descriptions, and means are shown in Table One.

Finally, the Census Transportation Planning Package is used to describe the transportation system in the metropolitan area. For every possible combination of residential zone and employment zone, the following four variables are created: a dummy variable for whether no individual commutes from the residential to the employment zone at peak commute time by car, the average peak commute time by car between those two zones, a dummy variables for whether no individual commutes between the two zones by mass transit, and average peak commute time by mass transit. The four variables are used to create eight corresponding residential access variables for the household sample. For the reference person and the reference person's spouse if present, their employment location is used to create an individual specific access measures for each residential location. The multinomial logit also will include family specific variables for whether the reference person or spouse is employed and if employed whether the employment location is known.

Estimation Results

Single Equation Tenure Choice Model

Table Two contains estimates for a traditional tenure choice model that does not include residential location characteristics, see for example Hendershott and Shilling (1982). A positive coefficient estimate implies that a family is more likely to reside in rental housing. Columns two, three, and four contain the estimates using a constraint variable based on rates of return of 3, 5, and 7 percent on liquid assets. Many of the standard results are replicated in this analysis. The likelihood of ownership increases with the age and education level of the reference individual and the reference individual's spouse (negative coefficient estimates). The likelihood of ownership is also increased by the presence of children or other household members. Predicted household income increases the likelihood of homeownership for whites. The race effect for predicted income (BLOGPINC) is insignificant, but the magnitude of the parameter is sizable. The estimated relationship between predicted income and homeownership is only half the size of the relationship for whites. The constraint variable lowers the likelihood of ownership for white households. The interaction between race and the constraint variable (BCONST) is significant, and depending on the model the effect of being constrained is 50 to 150 percent larger for African-Americans.

The last two rows of Table Two also show the racial differences in the effect of being constrained and in the effect of a 50 percent increase in predicted income on the predicted probability of renting over the entire sample. Being constrained increases the likelihood of African-American's renting by between 8 and 12 percentage points more than the increase for whites. On the other hand, a 50 percent increase in income should decrease the likelihood of

renting for all households, but the effect is between one and two percentage points smaller for African-Americans.

Table Three contains estimates for a tenure choice model including residential location attributes and the interaction of race with those attributes, which are labeled by a 'B' immediately preceding the variable name. The inclusion of the residential attributes affects the coefficients on both predicted incomes and the constraint variable. The interaction between race and predicted income increases in magnitude and becomes statistically significant in all three specifications. At the same time, the interaction between race and the constraint variable decreases in magnitude, and the significance level drops to the 10 percent level in two of the three specifications. In all three models, however, race still appears to increase the affect of being constrained by 50 percent or more. Based on the probabilities, the racial difference in the effect of the constraint has fallen to between 6 and 9 percentage points, and the racial difference for the increase in income has risen to between 2 and 3 percentage points.

Many of the coefficients on the location attributes are statistically significant and have reasonable signs. A higher percentage of owner-occupied residences increases the likelihood of ownership, as expected. The percent African-American lowers the likelihood of ownership for white households and increases the likelihood for African-Americans. The percent poverty has the opposite effect; raising the likelihood of homeownership for whites and having little effect on the likelihood of homeownership for African-Americans. It may seem unusual that whites are more likely to reside in neighborhoods with a high concentration of poverty. Remember, however, this result is based on controlling for the percentage of households that are African-Americans, and percent African-American households and percent in poverty are highly

correlated. White households on average may be willing to except a higher concentration of poverty in exchange for a less integrated neighborhood.

African-American's face a substantial level of housing segregation in many American metropolitan areas. These findings suggest that residential location attributes affect homeownership decisions and that these relationships vary by race. These findings illustrate the need for a model of homeownership that accounts for racial differences in residential location within a metropolitan area. These finding, however, should be interpreted with care. Residential location is a choice, admittedly a constrained choice, and simply including residential location characteristics in the tenure choice model may be inappropriate.

Table Four contains the estimates for a model that also controls for employment access variables. None of the employment access variables are statistically significant in a model. A likelihood ratio test, however, rejects the assumption that job access variables are not related to tenure choice, and furthermore the additional of these variables influences the racial differences in the effect of both being constrained and family income. As with Table Three, the employment access variables are the result of a residential location choice and may not be exogenous. These specifications illustrate the potential hazards of ignoring residential location in a study of tenure choice, but do not provide a solution to the problem. The next section estimates a multinomial model in which both homeownership and residential location are specified as household choices.

Nested Logit Model for Residential Location and Tenure Choice

Table Five presents the estimated coefficients on the residential location attributes from the first stage multinomial logit. Columns two and three show the coefficients on the attributes and the coefficients on interactions between race and the attributes for families residing in

owner-occupied housing. Columns four and five show the results for families residing in rental housing. The relative value of owning versus renting in a given residential location is described by the differences between the coefficient estimates for the owner-occupied and the renter models. Note that the choice specific coefficient estimates are not shown.

As expected, percent owner-occupied residences increases the likelihood of a homeowner choosing to reside in a specific location and lowers the likelihood of a renter choosing the location. For white owners and renters, percent of households in poverty and the housing cost index (PRICE) increases the likelihood of choosing a location, and percent black decreases the likelihood of choosing a location. However, the effect of percent poverty is larger for white owners that for white renters. The effect of percent in poverty is smaller for African-American owners, and this variable's effect on African-American tenure choice decisions appears to be small. The effect of housing costs on residential location choice does not persist for black homeowners, but for renters the effect does not vary by race. Finally, the percent black increases the likelihood that an African-American will choose a specific residential location regardless of tenure choice. The percentage of Black households does not appear to influence the value of owning relative to renting.

The counter-intuitive results for percent poverty and housing costs illustrate the hazards of simply including residential location characteristics in a single equation tenure choice model. In Table Two, percent poverty was found to increase the likelihood of homeownership for whites, but not for African-Americans; and this finding was interpreted as whites possibly preferring a increase in poverty over an increase in percentage black in the area. The finding persists in Table Five, but the interpretation is not consistent with the findings in Table Five.

Percent of households in poverty increases the likelihood of residing in a location for white and black households whether those households are owners or rents. There may be features of these residential zones that are correlated with percent poverty and increase the attractiveness of the zone especially if those features are not fully captured by the estimated housing cost index, which also has a counter intuitive results. These findings clearly require further investigation.

The employment location access variables are also highly significant. Longer commute times or a lack of any commuters along a certain path lowers the likelihood of an individual residing at one end of the path if they are employed at the other end. This result holds for both homeowners and renters, as well as for the family reference individuals and the reference individual's spouse. The effects of reference person's commute time appear to be larger for renters, and the effect of the spouse's commute time by mass transit is also larger. The effect of the spouse's commute time by car is less important for African-American households, but this variable does not appear to influence the value of owning relative to renting for either white or African-American households. Note that the variable representing no automobile traffic along a given path is not present for the spouse. Most commuting paths are travelled by automobile, and the coefficient is not identified for spouses.

Table Six shows the estimated coefficients for the second stage tenure choice equation. The coefficient estimate on the inclusive value is labeled by the variable INCL and the race interaction is labeled by the variable BINCL. Both parameters are statistically significant, within the acceptable range of zero to one, and imply that residential location and tenure choice cannot be treated as independent. In fact, the estimated coefficient on the interaction between race and the constraint variable is substantially larger than the estimates in Table Three and statistically

significant. The racial difference in the effect of being constrained is quite large, between 11 and 14 percentage points. The racial difference in the effect of an income increase is around 2 percent and very close to the results in Table Three.

Conclusions and Policy Issues

This paper suggests that the spatial pattern of employment may influence residential location decisions, which in turn have a large influence on the decision to purchase one's residence. Specifically, this study estimates a tenure choice model using the 1985 Philadelphia sample of the American Housing Survey. The traditional tenure choice model yields two results: 1. being credit constrained has a larger effect on the likelihood of homeownership for minority households, 2. there is no statistically significant evidence that racial differences exist in the effect of family income on homeownership. The tenure choice model is then extended to include the attributes of a family's residential location. The inclusion of residential location information increases the racial difference in the effect of family income, but reduces the racial difference in the effect of the constraint variable. Predicted family income appears to have a smaller effect on homeownership for African-American households, and the relationship between race and the effect of the constraint variable is only significant at the 10 percent level. A third specification allows tenure choice to depend on job access variables. The variables are jointly significant, and their inclusion affects the relationship between race and the effects of the constraint and family income variables.

Previous tenure choice studies have ignored the possible impact of job access on the tenure choice opportunity set. In this context, residential location must be considered a choice, and the attributes of a family's location cannot simply be included on the right hand side of a

tenure choice model. Rather, this paper estimates a nested multinomial logit of residential location and tenure choice. First the residential location choice model is estimated conditional on whether a household owns or rents. A comparison of the owner and renter versions of this model provides a measure value of owning as compared to renting based on the location opportunities available throughout the metropolitan area.

The tenure choice model is re-estimated after replacing the residential location characteristics with an index based on the choice model. The coefficient estimate on this index is significantly different from one, which indicates that a nested multinomial logit is the preferred specification. In this specification, the racial difference in the effect of the constraint variable is statistically significant, and in fact, is somewhat larger in magnitude than the difference in the original tenure choice model. The racial difference in the effect of predicted family income is also statistically significant, and a traditional tenure choice model appears to understate racial differences in the influence of family income.

The influence of both credit constraints and family income on homeownership vary by race. The availability of liquid assets for a downpayment appears to be more important for African-Americans than whites, but total family income appears to be less important for African-Americans. Gyourko, Linneman, and Wachter (1997a) and Wachter and Megbolugbe (1992) suggest a number of possible explanations for these findings: 1. less stable income stream for minorities, 2. differential wealth within extended families, 3. mortgage lending discrimination, and 4. equity risk based on neighborhood location choice or due to racial steering. These findings persist even after controlling for residential location choice, which casts some doubt on the equity risk explanation. This analysis controls for many residential location characteristics

that may explain equity risk, and the racial differences in the influence of constraints or income are not diminished.

Moreover, this paper suggests some alternative explanations for the existence of these racial differences. Access to mass transit appears to be more important to renters than owners, and this effect appears to be larger for minorities. The poor access to public transportation in many suburban neighborhoods, which provide superior homeownership options, may contribute to racial differences in homeownership especially if poor access is found in combination with racial discrimination in labor markets. Finally, the influence of percent poverty and the housing price variables on residential location choice also vary by both race and tenure choice. At present, we have not untangled the influence of these two variables. These variable may, however, be important in explaining spatial variation in homeownership outcomes between whites and African-Americans. We plan to investigate these variables further.

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Table 1. Variable Definitions and Means by Race

Name	Definition	White	Black
TENURE	Variable is one is resides in owner-occupied residence	0.612	0.441
LAGE	Years in labor market (Age minus years education plus six)	35.632	34.318
MAR	Variable is one if reference person married	0.562	0.310
SPAN	Variable is one if reference person is of Hispanic origins	0.028	0.015
SEX	Variable is one if reference person is male	0.689	0.462
COLGRAD	Variable is one if reference person is collage graduate	0.263	0.103
HSGRAD	Variable is one if reference person is high school graduate	0.509	0.523
SLAGE	Spouse if present years in labor market	18.081	0.757
SCOLGRAD	Variable is one if spouse is college graduate	0.110	0.046
SHSGRAD	Variable is one if spouse is high school graduate	0.361	0.200
REFSIB	Number of siblings residing with reference person	0.014	0.048
REFPRNT	Number of parents residing with reference person	0.011	0.016
REFOTHR	Number of other family members residing with reference person	0.069	0.229
REFCHLD	Number of children residing with reference person	0.902	1.077
KIDSLT6	Variable is one if any kids less than six present in household	0.154	0.206
VEHICL01	Variable is one if less than one automobiles present per adult	0.285	0.235
VEHICL1	Variable is one if there is at least one automobile per adult	0.560	0.272
CONST1	Variable is one if credit constrained (assumes 3% return)	0.091	0.514
CONST2	Variable is one if credit constrained (assumes 5% return)	0.132	0.560
CONST3	Variable is one if credit constrained (assumes 7% return)	0.156	0.577
PLOGINC	Logarithm of predicted total family income	10.327	9.985
PCTBLCK	Percent African American households in residential zone	0.136	0.515
PCTOWN	Percent owner occupants in residential zone	0.705	0.604
PCTPVTY	Percent households in poverty in residential zone	0.087	0.215
PCTHSP	Percent Hispanic households in residential zone	0.027	0.066
Sample Size		4196	984

Table 2. Estimated Coefficients for Tenure Choice Logit Model

Variable Name	Const1	Const2	Const3
INTERCPT	7.4029 (0.923)	7.2265 (0.923)	7.1082 (0.922)
LAGE	-0.0819 (0.010)	-0.0765 (0.011)	-0.0718 (0.011)
LAGE2	0.0502 (0.012)	0.0462 (0.012)	0.0424 (0.012)
MAR	0.4372 (0.314)	0.3919 (0.314)	0.4010 (0.313)
SPAN	0.4087 (0.226)	0.3520 (0.226)	0.3227 (0.226)
SEX	-0.0977 (0.093)	-0.1076 (0.093)	-0.1203 (0.093)
BLACK	-2.8034 (1.604)	-2.3196 (1.590)	-2.4141 (1.596)
COLGRAD	-0.2386 (0.132)	-0.2157 (0.132)	-0.1990 (0.132)
HSGRAD	-0.0866 (0.097)	-0.0774 (0.097)	-0.0682 (0.097)
SLAGE	-0.0770 (0.016)	-0.0727 (0.016)	-0.0714 (0.016)
SLAGE2	0.0969 (0.020)	0.0914 (0.020)	0.0896 (0.020)
SCOLGRAD	-0.9075 (0.207)	-0.8800 (0.207)	-0.8574 (0.207)
SHSGRAD	-0.4996 (0.155)	-0.5034 (0.155)	-0.5073 (0.155)
REFSIB	-0.5237 (0.208)	-0.4818 (0.207)	-0.4645 (0.207)
REFPRNT	-1.0920 (0.321)	-1.0639 (0.321)	-1.0526 (0.321)
REFOTHR	-0.0923 (0.081)	-0.0919 (0.081)	-0.0913 (0.081)
REFCHLD	-0.2770 (0.038)	-0.2654 (0.037)	-0.2561 (0.038)

Table 2. Estimated Coefficients for Tenure Choice Logit Model

Variable Name	Const1	Const2	Const3
KIDSLT6	-0.3140 (0.119)	-0.2927 (0.119)	-0.2827 (0.119)
VEHICL01	-0.4324 (0.123)	-0.4129 (0.123)	-0.4133 (0.123)
VEHICL1	-0.8485 (0.118)	-0.8047 (0.119)	-0.7933 (0.118)
CONST	0.4111 (0.170)	0.5440 (0.148)	0.6165 (0.141)
LOGPINC	-0.4004 (0.097)	-0.4040 (0.096)	-0.4080 (0.096)
BCONST11	0.6445 (0.226)	0.5104 (0.208)	0.4533 (0.203)
BLOGPINC	0.2483 (0.157)	0.1972 (0.156)	0.2059 (0.156)
Log Likelihood	-2609.56	-2606.93	-2604.92
Race by Effect of Constraint	0.119	0.095	0.085
Race by Effect of Income	0.017	0.014	0.015

Table 3. Estimated Coefficients for Tenure Choice Logit Model

Variable Name	Const1	Const2	Const3
INTERCPT	12.0832 (1.788)	11.8331 (1.792)	11.7618 (1.792)
LAGE	-0.0772 (0.010)	-0.0706 (0.011)	-0.0659 (0.011)
LAGE2	0.0004 (0.000)	0.0003 (0.000)	0.0003 (0.000)
MAR	0.5232 (0.318)	0.4845 (0.318)	0.4964 (0.317)
SPAN	0.7030 (0.246)	0.6594 (0.246)	0.6415 (0.246)
SEX	-0.1085 (0.095)	-0.1166 (0.095)	-0.1292 (0.095)
BLACK	-11.873 (3.317)	-11.4782 (3.307)	-11.5706 (3.3115)
COLGRAD	-0.4557 (0.137)	-0.4299 (0.137)	-0.4145 (0.137)
HSGRAD	-0.1962 (0.100)	-0.1855 (0.100)	-0.1781 (0.101)
SLAGE	-0.0807 (0.016)	-0.0765 (0.016)	-0.0754 (0.016)
SLAGE2	0.0010 (0.000)	0.0009 (0.000)	0.0009 (0.000)
SCOLGRAD	-1.0002 (0.209)	-0.9700 (0.208)	-0.9491 (0.208)
SHSGRAD	-0.5661 (0.156)	-0.5725 (0.156)	-0.5758 (0.155)
REFSIB	-0.4821 (0.217)	-0.4369 (0.217)	-0.4217 (0.217)
REFPRNT	-1.1304 (0.326)	-1.1031 (0.325)	-1.0959 (0.326)
REFOTHR	-0.1027 (0.082)	-0.1049 (0.082)	-0.1052 (0.082)
REFCHLD	-0.2748 (0.038)	-0.2626 (0.038)	-0.2530 (0.038)

Table 3. Estimated Coefficients for Tenure Choice Logit Model

Variable Name	Const1	Const2	Const3
KIDSLT6	-0.2864	-0.2599	-0.2500
	(0.121)	(0.121)	(0.121)
VEHICL01	-0.5929	-0.5727	-0.5757
	(0.130)	(0.130)	(0.130)
VEHICL1	-1.0789	-1.0335	-1.0293
	(0.129)	(0.130)	(0.129)
CONST11	0.5339	0.6665	0.7122
	(0.177)	(0.154)	(0.145)
LOGPINC	-0.4358	-0.4427	-0.4482
	(0.098)	(0.098)	(0.098)
ZPDIFF	-0.1606	-0.1277	-0.1355
	(0.367)	(0.369)	(0.369)
PCBLCK	0.8991	0.9307	0.9117
	(0.415)	(0.416)	(0.416)
PCTOWN	-4.0971	-4.1483	-4.1386
	(0.603)	(0.604)	(0.606)
PCTHSP	0.1962	0.2655	0.2231
	(1.322)	(1.324)	(1.328)
PCTPVTY	-8.5647	-8.7284	-8.7095
	(1.177)	(1.181)	(1.181)
BCONST11	0.5144	0.3876	0.3460
	(0.237)	(0.219)	(0.212)
BLOGPINC	0.3843	0.3425	0.3461
	(0.174)	(0.173)	(0.173)
BZPDIFF	2.6251	2.6196	2.6185
	(0.743)	(0.743)	(0.741)
BPCBLCK	-1.4211	-1.4329	-1.4226
	(0.664)	(0.662)	(0.660)
BPCTOWN	-2.1332	-2.1513	-2.0775
	(1.541)	(1.546)	(1.545)
BPCTHSP	2.8259	2.7783	2.8082
	(2.015)	(2.017)	(2.016)

Table 3. Estimated Coefficients for Tenure Choice Logit Model

Variable Name	Const1	Const2	Const3
BPCTPVTY	5.1499 (2.150)	5.3653 (2.152)	5.4088 (2.153)
Log Likelihood	-2525.40	-2521.58	-2519.96
Race by Effect of Constraint	0.093	0.071	0.064
Race by Effect of Income	0.026	0.023	0.024

Table 4. Estimated Coefficients for Tenure Choice Logit Model

Variable Name	Const1	Const2	Const3
INTERCPT	12.225	12.003	11.922
	(1.805)	(1.808)	(1.808)
LAGE	-0.078	-0.072	-0.068
	(0.011)	(0.011)	(0.011)
LAGE2	0.039	0.034	0.031
	(0.012)	(0.013)	(0.013)
MAR	0.531	0.490	0.498
	(0.324)	(0.323)	(0.323)
SPAN	0.700	0.658	0.636
	(0.247)	(0.248)	(0.247)
SEX	-0.088	-0.097	-0.109
	(0.095)	(0.096)	(0.096)
BLACK	-13.431	-13.051	-13.183
	(3.441)	(3.431)	(3.439)
COLGRAD	-0.433	-0.413	-0.398
	(0.138)	(0.138)	(0.138)
HSGRAD	-0.162	-0.155	-0.147
	(0.101)	(0.101)	(0.101)
SLAGE	-0.078	-0.074	-0.073
	(0.016)	(0.016)	(0.016)
SLAGE2	0.098	0.092	0.091
	(0.021)	(0.021)	(0.021)
SCOLGRAD	-0.994	-0.962	-0.942
	(0.212)	(0.211)	(0.211)
SHSGRAD	-0.578	-0.581	-0.584
	(0.157)	(0.157)	(0.157)
REFSIB	-0.477	-0.433	-0.419
	(0.217)	(0.216)	(0.216)
REFPRNT	-1.097	-1.076	-1.070
	(0.327)	(0.328)	(0.329)
REFOTHR	-0.109	-0.110	-0.110
	(0.083)	(0.083)	(0.083)
REFCHLD	-0.286	-0.274	-0.265
	(0.039)	(0.039)	(0.039)

Table 4. Estimated Coefficients for Tenure Choice Logit Model

Variable Name	Const1	Const2	Const3
KIDSLT6	-0.296	-0.270	-0.260
	(0.122)	(0.122)	(0.122)
VEHICL01	-0.558	-0.541	-0.543
	(0.131)	(0.131)	(0.131)
VEHICL1	-1.052	-1.010	-1.004
	(0.130)	(0.130)	(0.130)
CONST11	0.480	0.612	0.663
	(0.178)	(0.155)	(0.146)
LOGPINC	-0.441	-0.448	-0.452
	.(09970)	(0.099)	(0.099)
BCONST11	0.663	0.529	0.499
	(0.244)	(0.227)	(0.223)
BLOGPINC	0.521	0.484	0.490
	(0.193)	(0.192)	(0.194)
PCTOWN	-4.068	-4.122	-4.115
	(0.609)	(0.609)	(0.611)
PCTBLCK	0.916	0.945	0.927
	(0.418)	(0.419)	(0.419)
PCTHSP	0.102	0.155	0.120
	(1.330)	(1.333)	(1.336)
PCTPVTY	-8.566	-8.719	-8.710
	(1.184)	(1.188)	(1.188)
ZPDIFF	-0.133	-0.103	-0.110
	(0.370)	(0.371)	(0.371)
BPCTOWN	-2.267	-2.293	-2.198
	(1.569)	(1.572)	(1.571)
BPCTBLCK	-1.232	-1.237	-1.223
	(0.672)	(0.670)	(0.669)
BPCTHSP	2.896	2.860	2.863
	(2.029)	(2.030)	(2.030)
BPCTPVTY	4.830	5.022	5.092
	(2.182)	(2.181)	(2.181)
BZPDIFF	2.736	2.721	2.716
	(0.751)	(0.751)	(0.749)

Table 4. Estimated Coefficients for Tenure Choice Logit Model

Variable Name	Const1	Const2	Const3
NOCAR	1.114 (1.676)	1.151 (1.647)	1.107 (1.683)
NOMASS	-0.237 (0.321)	-0.235 (0.322)	-0.254 (0.323)
CTIME	-0.003 (0.008)	-0.003 (0.008)	-0.002 (0.008)
MTIME	-0.005 (0.005)	-0.005 (0.005)	-0.005 (0.005)
SNOMASS	1.046 (0.585)	1.035 (0.587)	1.021 (0.588)
SCTIME	-0.014 (0.015)	-0.015 (0.015)	-0.014 (0.015)
SMTIME	0.006 (0.009)	0.006 (0.009)	0.006 (0.009)
BNOCAR	-2.588 (2.334)	-2.606 (2.317)	-2.590 (2.347)
BNOMASS	1.099 (1.177)	1.202 (1.172)	1.303 (1.169)
BCTIME	-0.009 (0.024)	-0.013 (0.024)	-0.015 (0.024)
BMTIME	-0.006 (0.015)	-0.003 (0.015)	-0.002 (0.015)
BSNOMASS	-2.533 (1.965)	-2.330 (1.990)	-2.257 (1.986)
BSCTIME	0.079 (0.042)	0.077 (0.043)	0.075 (0.043)
BSMTIME	-0.044 (0.027)	-0.044 (0.027)	-0.042 (0.027)
Log Likelihood	-2508.24	-2505.25	-2503.33
Race by Effect of Constraint	0.119	0.095	0.090
Race by Effect of Income	0.035	0.033	0.033

Table 5. Estimated Coefficients for the Residential Location Choice Model

Variable Name	Homeowner		Renter	
	Level Effect	Race Effect	Level Effect	Race Effect
PCTOWN	1.621	-0.586	-3.313	-0.902
	(0.691)	(1.012)	(0.701)	(0.868)
PCTBLCK	-2.375	5.516	-1.987	4.109
	(0.391)	(0.569)	(0.453)	(0.510)
PCTHISP	-2.873	0.101	-0.817	1.052
	(0.951)	(1.131)	(0.933)	(1.106)
PCTPVRTY	7.254	-2.526	3.933	0.055
	(0.972)	(1.877)	(1.238)	(1.933)
NOCAR	-6.078	2.173	-5.551	0.582
	(0.909)	(1.274)	(0.794)	(1.410)
CTIME	-0.105	0.010	-0.138	0.014
	(0.005)	(0.017)	(0.008)	(0.018)
NOMASS	-1.896	-0.940	-2.619	0.250
	(0.180)	(0.783)	(0.299)	(0.863)
MTIME	-0.023	-0.015	-0.037	-0.002
	(0.003)	(0.010)	(0.005)	(0.011)
SCTIME	-0.132	0.074	-0.130	0.065
	(0.007)	(0.019)	(0.013)	(0.024)
SNOMASS	-3.350	-0.342	-2.831	0.139
	(0.300)	(0.944)	(0.691)	(1.005)
SMTIME	-0.029	-0.009	-0.038	0.011
	(0.005)	(0.013)	(0.011)	(0.019)
PRICE	0.760	-0.923	0.736	-0.035
	(0.321)	(0.557)	(0.528)	(0.751)
Log Likelihood	-13911.950			

Table 6. Estimated Coefficients for the Second Stage Tenure Choice Model

Variable Name	Const1	Const2	Const3
INTERCPT	8.145 (0.973)	7.964 (0.972)	7.834 (0.971)
LAGE	-0.083 (0.010)	-0.078 (0.011)	-0.074 (0.011)
LAGE2	0.048 (0.012)	0.044 (0.012)	0.041 (0.012)
MAR	0.362 (0.316)	0.308 (0.315)	0.314 (0.315)
SPAN	0.402 (0.227)	0.344 (0.227)	0.316 (0.226)
SEX	-0.079 (0.093)	-0.089 (0.093)	-0.101 (0.094)
BLACK	-0.334 (1.698)	0.124 (1.688)	0.049 (1.690)
COLGRAD	-0.214 (0.133)	-0.194 (0.132)	-0.178 (0.133)
HSGRAD	-0.054 (0.098)	-0.046 (0.098)	-0.037 (0.098)
SLAGE	-0.075 (0.016)	-0.07 (0.016)	-0.069 (0.016)
SLAGE2	0.095 (0.020)	0.089 (0.020)	0.088 (0.020)
SCOLGRAD	-0.929 (0.208)	-0.901 (0.208)	-0.879 (0.208)
SHSGRAD	-0.51 (0.156)	-0.513 (0.156)	-0.518 (0.155)
REFSIB	-0.515 (0.208)	-0.475 (0.207)	-0.461 (0.207)
REFPRNT	-1.08 (0.324)	-1.053 (0.325)	-1.042 (0.325)
REFOTHR	-0.111 (0.082)	-0.109 (0.082)	-0.109 (0.082)
REFCHLD	-0.282 (0.038)	-0.271 (0.038)	-0.262 (0.038)

Table 6. Estimated Coefficients for the Second Stage Tenure Choice Model

Variable Name	Const1	Const2	Const3
KIDSLT6	-0.324	-0.303	-0.293
	(0.120)	(0.120)	(0.120)
VEHICL01	-0.4	-0.381	-0.379
	(0.124)	(0.124)	(0.124)
VEHICL1	-0.819	-0.777	-0.764
	(0.118)	(0.119)	(0.119)
CONST11	0.369	0.503	0.575
	(0.171)	(0.149)	(0.142)
LOGPINC	-0.41	-0.412	-0.415
	(0.097)	(0.097)	(0.097)
INCL	-0.136	-0.135	-0.133
	(0.057)	(0.057)	(0.057)
BCONST11	0.775	0.641	0.615
	(0.230)	(0.213)	(0.209)
BLOGPINC	0.342	0.288	0.303
	(0.159)	(0.158)	(0.158)
BINCL	-0.838	-0.827	-0.852
	(0.187)	(0.188)	(0.189)
Log Likelihood	-2592.84	-2590.67	-2588.11
Race by Effect of Constraint	0.138	0.114	0.109
Race by Effect of Income	0.024	0.020	0.022