Neighborhood Externality Risk and the Homeownership Status of Properties

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Abstract

In contrast to corporate and institutional investors, single owner-occupiers cannot adequately diversify housing investment risk. *Ceteris paribus*, homeownership should be relatively less likely in places with higher housing investment risk. Using the American Housing Survey, it is documented that neighborhood externality risk, a major component of housing investment risk, substantially reduces the probability that a housing unit is owner-occupied, having controlled for housing type, turnover probability of the unit, household-specific characteristics, and location-specific characteristics, including the levels of neighborhood externalities as well as MSA-level and center city unobservable characteristics. Depending on the type of externality, model specification, and sample used, a decrease of one specific risk variable by one standard deviation increases the probability that a unit is owner-occupied between 1.5 percent and 12.3 percent. An analysis of units that change their homeownership status suggests that this effect may be causal.

JEL classification: D81, G11, R21, R31.

Keywords: Homeownership, neighborhood externality risk, portfolio diversification.

1. Introduction

Changes in neighborhood amenities can have considerable effects on house prices. Moreover, the likelihood of such changes can vary significantly between neighborhoods. Neighborhood uncertainty is therefore associated with substantial neighborhood-specific housing-investment risk. This simple observation raises some interesting questions. Do potential homebuyers take into account the risk of changes in neighborhood amenities when they decide in which neighborhood they want to invest? Does neighborhood-specific risk thereby affect the probability that a property is owner-occupied? This paper addresses these questions. Specifically, the paper examines whether between 1985 and 1999, neighborhood externality risk variables, directly measured as the standard deviations of four types of neighborhood externalities — junk, litter, and trash in the neighborhood, street noise, neighborhood noise, and neighborhood crime — negatively affect the likelihood that a specific housing unit is owner-occupied

Furthermore, the paper examines the importance of neighborhood uncertainty for the low homeownership rates of inner cities. Inner cities typically have greater neighborhood uncertainty compared to suburban and rural places.[1] Inner cities also generally have a more poorly maintained housing stock, a lack of social capital, substantial juvenile crime problems, and low quality schools. Interestingly enough, recent research links these inner city problems to low homeownership rates. For example, Galster (1983) suggests that because of moral hazard problems, tenants treat their units less carefully than homeowners. Rossi and Weber (1996) and DiPasquale and Glaeser (1999) suggest that homeownership benefits social capital. Green and White (1997) show that homeownership provides a better environment for bringing up children. Hilber and Mayer (2002) show that the positive correlation between population density and school spending persists only in places with high homeownership rates. Finally, Fischel (2001) suggests that places with high homeownership rates may also have better control over local government. Because of these findings, a better understanding of the causes of the low homeownership rates of inner cities should be developed.[2]

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1 An initial analysis of the American Housing Survey for the years 1985 and 1999 indicates that center city locations and neighborhood externality-risk measures are positively related. A similar link between inner cities and housing investment risk was suggested in an earlier study. Rachlis and Yezer (1988) estimate real estate investment risk as the variance of the errors in an appraisal equation and show that such appraisal risk is related to inner city locations.

2 The phenomenon of particularly low homeownership rates of inner cities can be partially explained by segregation of households with different characteristics. Segregated groups may have different income or wealth and may be differently affected by federal tax laws, borrowing constraints, or racial discrimination on capital markets. Furthermore, the households of different segregated groups may differ in their life-cycle attributes and in their

The previous housing literature has mainly focused on household-specific characteristics as determinants of the individual tenure choice.[3] However, the role of location-specific factors as determinants of the homeownership status of properties is an underdeveloped area of research. The user-cost literature (*e.g.*, Rosen, 1979; Hendershott, 1980; Hendershott and Slemrod, 1983; Poterba 1984) argues that lower user cost of housing is expected to increase the probability of owning and the quantity of housing consumed. At any point in time, some factors driving user costs (*e.g.*, maintenance costs) may vary between regions and metropolitan statistical areas (MSAs) but barely between nearby neighborhoods. Thus, user costs fail to explain cross-sectional differences in homeownership rates between neighborhoods. Linneman (1985) points out that apartment buildings have a higher relative landlord production efficiency compared to single-family homes. Consequently, housing units are less likely to be owner-occupied in densely populated neighborhoods than in sparsely populated ones.

Risk variables that are related to housing, particularly neighborhood externality risk measures, are yet other potentially important — but frequently overlooked — location factors that may determine the homeownership status of properties.

The main proposition of this paper, which is founded on the literature that followed Henderson and Ioannides (1983) states that owner-occupiers typically have to "overinvest" in housing because of an investment constraint induced by owner-occupied housing. Thus, in contrast to corporate and institutional investors,[4] the constrained owner-occupier households cannot adequately diversify their portfolios. Because a reduction in housing investment risk (*e.g.*, neighborhood externality risk) increases the optimal housing investment, it thereby reduces the portfolio distortion associated with owner-occupied housing and increases the probability of homeownership.

Section 2 summarizes the theoretical literature that rationalizes the main proposition of this paper and discusses the results of related empirical work that links risk variables to the housing

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uncertainty about future income. However, all these determinants fail to fully explain why homeownership rates are so extremely low in inner cities; thus, the literature often has to rely on the argument that households that prefer center city places also have some intrinsic preferences for renter-occupation.

[3] It is now widely recognized that factors such as basic demographic variables (*e.g.*, Eilbott and Binkowski, 1985; Gyourko and Linneman, 1996), borrowing constraints (Linneman and Wachter, 1989), race (*e.g.*, Kain and Quigley, 1972, Gyourko *et al,* 1999, Painter *et al*, 2000), expected length of stay (*e.g.*, Haurin and Gill, 2002), and taxes (*e.g.*, Rosen, 1979) are major determinants of the individual housing-tenure choice (*i.e.*, the decision of households whether to own or rent the home).

[4] Shareholders of public investment companies can adequately diversify their portfolios by holding shares of companies with differing risk-return compositions. Similarly, private corporate and institutional investors can adequately diversify the unsystematic portion of the involved investment risk if they hold larger asset portfolios.

tenure. Section 3 describes the data and some basic features of the neighborhood externality risk measures. Section 4 tests the main proposition using housing-unit-specific data from the American Housing Survey (AHS) and provides strong evidence that neighborhood externality risk variables are negatively related to the probability that a unit is owner-occupied, even after controlling for the housing type, the turnover probability of the unit, household-specific characteristics, and location-specific characteristics including the levels of the neighborhood externalities, as well as center city and MSA-level unobservable characteristics. This suggests that owner-occupiers — in contrast to other investors — avoid neighborhoods with high externality risk. The outcome is robust toward the inclusion or exclusion of other variables that potentially explain the homeownership status of properties. Furthermore, the effects of the risk measures on homeownership are not only statistically significant but also quantitatively meaningful. Interestingly, quantitative effects — measured as the percentage change in the probability of homeownership as a reaction to the change of the explanatory variable by one standard deviation — are most meaningful for the risk variables of the most visible and obvious externalities, that is, junk, litter, and trash in the neighborhood and street noise. The quantitative effects of the statistically significant measures of neighborhood externality risk range from 1.5 percent to 12.3 percent, depending on the type of externality, model specification, and sample used.

Moreover, the empirical analysis reveals that neighborhood externality level variables and center city unobservable characteristics no longer have a quantitatively meaningful effect on the probability that a housing unit is owner-occupied if one properly controls for neighborhood externality risk measures. The latter finding suggests that neighborhood externality risk provides an alternative explanation for why homeownership rates are so low in many inner city neighborhoods.

Finally, the empirical section addresses potential concerns such as measurement error or the question of endogeneity and causality, that is, the concern that neighborhood externality risk measures might be endogenously determined and that homeownership status affects the neighborhood externality risk measures rather than the other way around. Unfortunately, the AHS does not provide appropriate instrumental variables that would identify neighborhood externality risk. However, an analysis of changes in the homeownership status of properties suggests that a reversed causality may be rather unlikely. The paper concludes with a discussion of the results and with policy implications in section 5.

2. Uncertainty, Investment Decisions, and Homeownership Status

Several theoretical models imply that neighborhood uncertainty — a major component of house price uncertainty — affects the homeownership status of properties. In a seminal paper, Henderson and Ioannides (1983) develop a housing investment-consumption model that provides a basis for analyzing housing demand and tenure choice. Their model acknowledges that owner-occupied housing involves both a consumption choice and a portfolio decision. The key element of their model is an investment constraint that requires that homeowners must own at least as much housing as they consume.[5] Fu (1991) further develops the Henderson and Ioannides framework and concludes that an increase of the investment risk (variation in house prices) reduces the optimal housing investment. Consequently, an increase in investment risk enlarges the distortion associated with owner-occupied housing.[6] This makes homeownership relatively more costly and reduces the probability that households own their home. While Henderson and Ioannides (1983) and Fu (1991) omit risky assets other than housing, Brueckner (1997) provides a formal analysis of the "overinvestment" issue of owner-occupied housing in a framework with several risky assets including owner-occupied housing. Using a combination of the housing investment-consumption model of Henderson and Ioannides (1983) and the standard mean-variance portfolio framework, as presented by Fama and Miller (1972), Brueckner demonstrates that when the investment constraint induced by owner-occupied housing is binding, homeowners cannot adequately diversify their portfolio.[7] In contrast to other investors, they therefore have to pay a risk premium that increases with the corresponding risk. Consequently, investment constrained households that decide to own their homes, *ceteris paribus*, prefer to invest in a neighborhood with low house price uncertainty.[8] Housing units in risky neighborhoods should therefore be less likely to be owner-occupied.[9]

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5 This results from the absence of partial-ownership arrangements that typically are considered to be unfeasible.

6 This distortion potentially increases because most homeowners strongly leverage their investments in owner-occupied housing.

7 Goetzmann (1993) provides empirical evidence that there are substantial gains to creating large portfolios of residential properties compared to an investment in one single home. Analyzing the risk and return to investments in residential properties in four urban U.S. markets over the period from 1971 to 1985, Goetzmann shows that, for a given return, large portfolios of residential properties are much less risky than an investment in one single home.

8 This implicitly assumes that households typically make their housing tenure decision before they decide in which location to own or rent. Of course, households with strong preferences for certain locations may also adjust their tenure choices based on neighborhood-specific characteristics. A model that tries to simultaneously estimate the individual location decision and tenure choice goes beyond the scope of this paper.

9 The same conclusion can also be derived from a model that analyzes the tenure choice of households in a dynamic framework and under uncertainty of income and housing costs (*e.g.*, Ortalo-Magné and Rady, 2002).

On the empirical side, a few studies link measures of uncertainty to the housing tenure. For example, Haurin (1991) and Robst *et al* (1999) focus on income uncertainty as a determinant of the housing tenure. The results of both studies indicate that income uncertainty reduces the likelihood of households to own their homes. Sinai and Souleles (2001) consider the trade off between the uncertainty of renting and house price uncertainty. They argue that with renting, the long-term cost of obtaining housing is unknown. Their empirical results indicate that the rent hedging benefit associated with owner-occupied housing significantly increases the homeownership rate. Rent hedging benefits may be small, however, for neighborhood-specific rent uncertainty. Tenants are expected to be less sensitive toward neighborhood-specific uncertainty of rents because — in contrast to owner-occupiers — they are typically compensated for shocks to neighborhoods with corresponding adjustments in rents. A few empirical studies focus specifically on the link between housing investment risk and the tenure choice. Rosen, Rosen, and Holtz-Eakin (1984) use national time series data from 1956 to 1979 and provide evidence that volatility in the relative price of housing services has a negative effect on the aggregate proportion of homeowners. Fishback (1992) provides historical evidence in favor of the main proposition of this paper. In the early 1900s companies of the risky coal mining industry created their own company towns and provided housing for their employees. One main reason for these exclusively renter-occupied company towns was the involved housing investment risk. Finally, Turner (2001) uses individual housing data from the AHS and a home price index at the MSA level to construct a price volatility measure. She finds evidence that families are less likely to own during periods of relatively high, anticipated house price volatility. One limitation of her approach is that the house price volatility variable is measured only at a fairly aggregated level, that is, at the MSA level. However, house price volatility varies also strongly within MSAs and, thus, the aggregated measure fails to explain neighborhood-specific differences in the likelihood that a housing unit is owner-occupied.

In order to empirically test the prediction that neighborhood-specific housing investment risk affects the homeownership status of properties, one would need house price variation data at a much less aggregated level. Unfortunately, such data — that is, the variation of true individual house prices over time or neighborhood-specific repeat sales price indexes — hardly exists.[10] However, the same theoretical considerations and predictions that apply for housing investment risk

[10] This is because housing units are typically sold only rarely, and therefore, the available data do not allow researchers to calculate a reliable price variation measure for specific housing units and makes it very difficult to calculate reliable neighborhood-specific indexes of house prices.

also apply for neighborhood externality risk — a measure than can be derived from the AHS — as long as neighborhood characteristics are capitalized into house values.

Hedonic house price regressions that use data from the AHS for 1985 and 1999 and control for characteristics of the housing unit, housing type, and various location characteristics (such as MSA and center city unobservable characteristics) suggest that neighborhood externalities (such as junk, litter, and trash, street noise, or crime) are negatively related to house prices. Regressions that additionally include neighborhood externality risk measures indicate that neighborhood uncertainty is strongly negatively related to house prices.[11] While such basic hedonic regressions may be criticized because of omitted variable problems, other empirical studies that use enhanced methods strongly confirm that neighborhood characteristics (*e.g.*, Grieson and White, 1989; Dubin, 1992)[12] and neighborhood uncertainty (Furman Speyrer, 1989)[13] are capitalized into house values. Moreover, recent studies reveal that neighborhood changes can have quite substantial effects on house prices. For example, Lynch and Rasmussen (2001) provide empirical evidence for Jacksonville, FL that neighborhoods have a devastating loss in property values if the neighborhood crosses a certain high crime threshold. Houses that are in the top two cost-of-crime deciles are discounted about 39 percent relative to a comparable house in the other areas. Bogart and Cromwell (2000) find that disruption of neighborhood schools in an Ohio school district reduces house values by approximately 10 percent. All these findings suggest that neighborhood characteristics are related to house prices and that neighborhood externality risk is a major component of housing investment risk. Consequently, one can predict that, after controlling for everything else, housing units should be more likely to be owner-occupied in neighborhoods with relatively low neighborhood externality risk. The empirical analysis below tests this prediction and examines whether high neighborhood externality risk also partly explains the low homeownership rates of inner cities. Section 3 describes the data. Section 4 then provides empirical evidence.

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[11] These results — and all other results that are not reported as tables in the paper — are available from the author upon request.

[12] Grieson and White (1989) argue that the reason for the lack of empirical evidence in earlier studies is that vacant land subject to positive externalities may be rezoned in the future. The possibility of a zoning change increases the value of the parcel, obscuring the effect of the externality. Thus, they formulate a new specification of neighborhood externalities that takes into account their argument. Dubin (1992) omits all neighborhood and accessibility measures from the set of explanatory variables and instead models the resulting autocorrelation in the error term. Both approaches provide strong evidence for capitalization of neighborhood amenities into house prices.

[13] Furman Speyrer (1989) provides empirical evidence that single owner-occupiers in Houston are willing to pay house price premiums for zoning and restrictive covenants that reduce neighborhood uncertainty.

3. Data Description and Summary Statistics

The data used in the empirical analysis is drawn from the American Housing Survey (AHS) conducted by the Bureau of the Census for the Department of Housing and Urban Development (HUD). More specifically, the analysis is based on the national surveys that are collected every other year between 1985 and 1999. These surveys cover on average 55,000 repeatedly evaluated housing units and their occupants in the United States.

The data set used in this analysis provides a large array of household-, unit- and location-specific variables including the homeownership status of properties, neighborhood externality and quality information, housing unit quality information, detailed household characteristics, mover information, housing type, MSA-information and center city status (see table A1 in the Appendix for a list of all variables included in the empirical analysis).[14] In particular, the set of neighborhood-specific variables includes four neighborhood externality level-variables: Junk, litter, and trash in the neighborhood, street noise in the neighborhood, neighborhood noise and neighborhood crime.[15] Three of the four variables were directly obtained from the interviewed households by asking them to value the quality of the specific neighborhood amenities. The exception is the measure for junk, litter, and trash. Until 1995, Census Field Representatives assessed this externality when making a visit to conduct the interview. Starting in 1997, all respondents were asked directly about the level of junk, litter, and trash in their neighborhood. The four corresponding neighborhood externality risk variables are created by calculating the standard deviations of the time series of the four neighborhood externality level-variables between 1985 and 1999.[16]

The data set excludes units that are mobile, vacant, or occupied by households that do not pay a market rent. Table A1 in the Appendix describes the variables used in the logit regressions for 1985 and 1999. Most variables do not vary significantly between 1985 and 1999 and reflect national changes in demographics and economic conditions. However, the means of certain neighborhood externality variables vary substantially between certain years. This is due to changes

[14] The AHS does not disclose the exact location (street address or Census tract information) of the housing units. Because of this limitation, average evaluations of all occupants in a neighborhood are not available.

[15] For the condition "junk, litter, and trash" the possible answers in the AHS are no accumulation (coding of variable: 0), minor accumulation (1), major accumulation (2). For the conditions "street noise" and "neighborhood crime," the possible answers are does not exist (0), exists (1), objectionable, don't wish to move (2), objectionable, wish to move (3). For the condition "neighborhood noise," the possible answers are does not bother (0), bothers (1).

[16] Standard deviations were also created for units with missing values for certain years.

in economic conditions such as the economic boom in the 1990s and due to changes in the way the survey is conducted.[17]

Table 1 reports the percentage of units that had no change in a specific neighborhood externality variable, had a change in both directions, or had a steady decrease or increase in the valuation of the neighborhood externality between 1985 and 1999. The results demonstrate that most units with neighborhood externality variation experience a random variation rather than a steady improvement or decline.

TABLE 1
Changes in Neighborhood Externality Variables between 1985 and 1999

Neighborhood externality	Percentage of Units, 1985-1999			
	Stable	Changes in both directions	Only decreasing or stable	Only increasing or stable
Junk, litter, and trash	25.0	64.6	8.4	2.0
Street noise	31.0	60.8	4.7	3.5
Neighborhood noise	69.4	25.0	4.2	1.4
Neighborhood crime	40.0	53.1	3.9	3.0

Notes: The four samples (one for each externality) include all housing units with no missing values that are included in the base regressions for 1985 and 1999 (table 2). The distributions are virtually the same for samples that include all available housing units from the AHS with no missing values.

4. Empirical Specification and Results

The probability of homeownership is estimated using a traditional binary maximum-likelihood logit[18] specification as described in equation (1):

[17] According to the "Documentation of Changes in the 1997 American Housing Survey" the change in data collection, as well as the data coverage improvement by collecting information for single-unit structures, led to shifts in the overall data reported. In particular, before 1997, Census field representatives assessed certain neighborhood-specific variables when making a visit to conduct the interview or to update the address listings for multi-unit buildings. Starting in 1997, all respondents were asked directly about these neighborhood-specific variables. This change explains why the mean of the variable for junk, litter, and trash differs significantly between the 1997–99 period and earlier years. The reason is that prior to 1997, single-unit structures were visited only when a phone interview was not possible. Consequently, single-unit structures — which typically are in neighborhoods with less junk, litter, and trash — have more missing values in the years prior to 1997. In order to confirm that the correlations between the neighborhood risk measures and the housing tenure variable are not due to potential changes in the way the survey is conducted, the binary logit models presented in section 4 were also re-estimated using adjusted neighborhood externality risk measures. For each unit and year, the adjusted neighborhood externality variables were calculated as the reported values divided by the means. As expected, the results of the estimates are similar to the ones reported in section 4.

[18] Li (1977) first justified the use of logit models for the empirical analysis of homeownership. Since then, logit models have become the major estimation technique of homeownership. However, in order to test whether the tails of the distributions significantly influence the results, the probability of ownership was also estimated using a probit specification. The results turn out to be very similar; that is, they are robust toward the choice of the estimator.

$$\Pr\left(OWN_i = 1 \middle| X_i\right) = \frac{\exp\left(X_i\beta\right)}{\left[1+\exp\left(X_i\beta\right)\right]}, \tag{1}$$

where $\Pr\left(OWN_i = 1 \middle| X_i\right)$ is the probability that the i[th] housing unit is owner-occupied, X_i is a vector of explanatory variables, and β is a vector of logistic regression coefficients. The next subsection describes the basic empirical model in more detail.

A. Basic Empirical Model and Results

(i) Basic Empirical Model of Homeownership Status

The main prediction of this paper is that, after controlling for everything else, housing units are more likely to be owner-occupied in neighborhoods with low rather than high neighborhood externality risk. Hence, the basic empirical model must include variables that measure neighborhood externality risk as well as all other variables that are expected to explain the homeownership status of the housing units. The basic empirical model is as follows:

$$\Pr(OWN_i = 1) = f(NER_i, NE_i, Demographics_i, Housing\ Type_i, Location\ Controls_i), \quad (2)$$

where NER_i and NE_i describe vectors of neighborhood externality risk- and level-variables.

Table 2 reports coefficients and robust standard errors.[19] Table 3 reports the means, standard deviations, marginal effects,[20] elasticities, and quantitative effects (i.e., the percentage change of the probability of homeownership as a reaction to the change of a dependent variable by one standard deviation) for the focal variables — that is, the neighborhood externality risk measures. In addition, quantitative effects are reported for all other variables in table A2 in the Appendix.[21]

Two alternative model specifications are estimated. The first specification (Regression I) assumes perfect foresight about neighborhood externality variation. In contrast, the second specification (Regression II) assumes that expectations are built on past experience.

Regression I estimates the probability of homeownership in 1985. The sample includes 37,690 housing units. The list of explanatory variables includes the four neighborhood externality risk variables that measure the variations of the four specific neighborhood externality level variables between 1985 and 1999. All other variables that are expected to explain the

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[19] All logit regressions in this empirical section use the Huber/White-sandwich estimator of variance. This estimator of the variance–covariance matrix is heteroskedasticity-consistent and provides robust standard errors. The reported robust standard errors are very similar to the ordinary standard errors.

[20] In the logit model, the marginal effects $\partial E[y|x]/\partial x$ can be calculated as $\Pr(y=1)\cdot[1-\Pr(y=1)]\cdot\beta$. The marginal effects and elasticities reflect the changes in the probability for an infinitesimal change in each independent, continuous variable and, by default, the discrete change in the probability for dummy variables.

[21] Quantitative effects are calculated as the standard deviation of the risk measure divided by the mean and multiplied by the elasticity. These calculated values are only correct for marginal changes in the explanatory variable. For larger changes, the calculated values can only be considered as approximations. Furthermore, for discrete variables, the values are difficult to interpret. However, these percentage numbers allow a direct comparison of quantitative effects for different explanatory variables. See table A2 in the Appendix for a comparison.

homeownership status are measured for 1985. Thereby, it is assumed that households have perfect foresight in assessing neighborhood externality risk.

TABLE 2
Binary Logit Estimate of Homeownership Status (Base Regression), 1985 and 1999

Independent Variables	Regression I: 1985 Parameter Estimates		Regression I: 1985 Robust Std. Err.	Regression II: 1999 Parameter Estimates		Regression II: 1999 Robust Std. Err.
Intercept	1.18	**	.063	.30	**	.074
Std. dev. of junk, litter, trash 85-99	-.53	**	.066	-.62	**	.071
Std. dev. of street noise, 85-99	-.25	**	.042	-.27	**	.048
Std. dev. of neigh. noise, 85-99	-.31	**	.094	-.45	**	.11
Std. dev. of neigh. crime, 85-99	-.12	**	.037	-.15	**	.044
Two or more unit building	-2.92	**	.060	-2.51	**	.067
Unit is a single detached house	.76	**	.052	1.05	**	.054
Unit is in center city	-.057		.042	-.10	*	.052
Household income (in '000)	.021	**	.0011	.014	**	.00081
20 ≤ av. age of adults<25	-1.86	**	.073	-1.68	**	.10
25 ≤ av. age of adults<30	-1.10	**	.049	-.99	**	.064
40 ≤ av. age of adults<45	.091		.063	.19	**	.061
45 ≤ av. age of adults<55	.22	**	.056	.40	**	.056
55 ≤ av. age of adults<65	.47	**	.056	.91	**	.074
Family	.19	**	.054	.57	**	.057
Married couple	.56	**	.046	.19	**	.050
Children	-.71	**	.043	-.28	**	.049
Ethnicity is Black	-.35	**	.054	-.36	**	.063
Previous residence outside US	-1.32	**	.20	-1.09	**	.19
Junk, litter, trash in neighborhood	-.072		.037	.013		.052
Street noise	-.050	*	.021	-.049		.027
Neighborhood noise	-.049		.069	.036		.12
Neighborhood crime	.049	*	.021	.088	**	.030
MSA dummies	Yes			Yes		
Number of observations	37,690			25,287		
Log-likelihood	-12,734			-8,492		

Notes: Dependent variable: 1 if unit is owner-occupied, 0 if unit is rented. ** Indicates significance at the 1 percent level, * indicates significance at the 5 percent level. Standard errors are robust standard errors using the Huber/White-sandwich estimator of variance. The logit model for 1985 (1999) contains 143 (144) MSA dummies that are not reported individually in the table. Percent of correct predictions = 86.5 percent (1985) and = 86.4 percent (1999), where a 0.5 threshold was used. In Regression I for 1985, 15 observations (that is, .04 percent of all observations with no missing values) were dropped in order to create a sample that is comparable with the equivalent regressions for 1985 in table 5.

Regression II considers that households may not be able to assess future neighborhood externality risk and therefore take past experience into account. The empirical model for 1999

includes the four risk variables that measure the past neighborhood externality variation between 1985 and 1999. All other explanatory variables are measured for 1999. The sample for 1999 includes 25,287 housing units. The neighborhood externality level variables — junk, litter, and trash, street noise, neighborhood noise, and neighborhood crime — are included in the equation in order to control for the possibility that the level of neighborhood externalities rather than the neighborhood externality risk measures affect the homeownership status. Two variables describe the housing type. These variables control for relative landlord production efficiency differences as described by Linneman (1985). Furthermore, the basic empirical model contains several location-specific variables. One dummy variable describes the center city status and controls for center city unobservable characteristics such as potentially intrinsic preferences of center city residents for renting. One dummy variable for each MSA in the sample controls for MSA-level unobservable characteristics such as potential user-cost differences between specific MSAs. Finally, household-specific covariates are included in order to capture other factors that affect the demand for housing. Specifically, the vector of explanatory variables includes several traditional household-specific variables such as average age of adult household members, household income, family status, marital status, immigration status, and ethnicity of household head.[22]

TABLE 3
Marginal Analysis for Risk Measures Using the Base Regression

	Risk Measures (Std. Dev., 85-99)	Marginal Effects	Mean	Std. Dev.	Elasticity	Quantitative Effects
Regression I *1985*	Junk, litter, and trash	-.11 **	.28	.31	-.045 **	-5.0% **
	Street noise	-.050 **	.56	.47	-.043 **	-3.6% **
	Neighborhood noise	-.062 **	.13	.21	-.012 **	-2.0% **
	Neighborhood crime	-.024 **	.54	.54	-.020 **	-2.0% **
Regression II *1999*	Junk, litter, and trash	-.12 **	.24	.31	-.045 **	-5.4% **
	Street noise	-.052 **	.52	.47	-.043 **	-3.8% **
	Neighborhood noise	-.084 **	.12	.21	-.012 **	-2.5% **
	Neighborhood crime	-.028 **	.51	.54	-.020 **	-2.3% **

[22] Only household wealth is not included because the data are not available from the AHS. One can expect that other household-specific variables — such as household income and average age of household members — may proxy reasonably well for household wealth. Nevertheless, the exclusion of household wealth is a concern because omitted wealth may be correlated with neighborhood externality risk. Using the Survey of Consumer Finances for 1998, the author imputed several wealth variables (based on different specifications). The overall fits are reasonably good, but the imputed wealth variables are not particularly well identified. With this caveat, several additional logit estimates for 1999 were carried out using the imputed wealth variables. While the coefficient on imputed wealth is always positive and strongly significant, the coefficients and statistical significance levels of the four neighborhood externality risk measures virtually don't change.

Notes: ** Indicates significance at the 1 percent level, * indicates significance at the 5 percent level. The marginal effects, elasticities, and quantitative effects are calculated at the means of the independent variables. Quantitative effects are measured as the percentage change of the probability of homeownership as a reaction to the change of a specific risk variable by one standard deviation.

(ii) General Regression Results

The estimated logit models strongly confirm the expected negative effect of neighborhood externality risk measures on the probability that a housing unit is owner-occupied. In addition, all other traditional explanatory variables, including all household-specific variables, have the expected signs and are statistically significant at the 1 percent level. Only the center city dummy variable and the neighborhood externality level variables (with one exception) are not statistically significant at the 1 percent level. The logit regressions for 1985 and 1999 predict 86.5 percent and 86.4 percent of the actual housing tenures correctly. Hence, the prediction of a housing unit's homeownership status is quite accurate in both regressions.

(iii) Influence of Neighborhood Externality Risk

In both logit models, 1985 and 1999, the coefficients of the externality risk measures are always negative and statistically significant at the 1 percent level. This suggests that the four neighborhood externality risk measures are negatively related to the probability of homeownership. Furthermore, the coefficients do not vary considerably between the two logit models. This result has two possible explanations: (1) Households may be forward- as well as backward-looking in valuing neighborhood externality risks or (2) externality risks in a neighborhood may be relatively constant over a longer period of time.

The results of the marginal analysis in table 3 suggest that certain neighborhood externality risk measures have quite a strong effect on homeownership status. The risk measure of the most visible externality — junk, litter, and trash in the neighborhood — has the quantitatively strongest effect on homeownership. An increase of the risk measure by one standard deviation reduces the probability that a unit is owner-occupied by 5.0 percent in the regression for 1985 and 5.4 percent in the regression for 1999. The magnitudes of the effects of the other neighborhood externality risk measures are somewhat smaller. An increase of the risk measure for street noise by one standard deviation reduces the probability of homeownership by 3.6 percent (1985) and 3.8 percent (1999). The quantitative effects of the risk measures for neighborhood noise and neighborhood crime are between –2.0 and –2.5 percent for both years. Overall, the risk measures of the more visible or obvious externalities (junk, litter, and trash and street noise) have a far stronger quantitative

negative impact on the homeownership status of properties than the less visible or obvious externalities (neighborhood noise and neighborhood crime). This result suggests that the more visible, obvious externalities either concern the residents more or can be better evaluated by them.[23]

(iv) Controlling for Neighborhood Externality Levels

The regressions in table 2 include variables that measure the levels of neighborhood externalities. Potential homebuyers might have relatively stronger preferences than potential new tenants for low levels of neighborhood externalities. To the extent that neighborhood externality risk measures are related to the corresponding neighborhood externality level variables, omitting the level variables could bias the effects of the neighborhood externality risk measures on homeownership.

The coefficients of most neighborhood externality level variables are statistically insignificant. The coefficient on the variable "street noise" is negative and statistically significant at the 5 percent level for 1985. Interestingly, the coefficient on the variable "neighborhood crime" is positive in both specifications and statistically significant at the 5 percent level for 1985 and at the 1 percent level for 1999. Overall, the neighborhood externality level variables have a relatively weak effect on homeownership if one properly controls for the corresponding risk measures. A closer look at the magnitude of the effects reveals that the quantitative significance of the neighborhood externality level variables is relatively minor compared to the effects of the risk variables. Increasing the externality street noise by one standard deviation reduces the probability that a unit is owner-occupied by 1.4 percent for 1985. The effect of neighborhood crime is positive and of similar magnitude (1.3 percent for 1985 and 1.8 percent for 1999).

A potential concern is that the specific coding of the neighborhood externality level variables may affect the statistical and quantitative significance of the risk measures. For example, the variable "junk, litter, and trash" equals 0 if the neighborhood has no accumulation of junk, litter, or trash. The variable equals 1 if the neighborhood has a minor accumulation and 2 if the

[23] If the neighborhood externalities are barely visible or obvious for "outsiders," recent movers can hardly build up their own reliable expectations about future neighborhood externality risk. Rather, they have to rely on available information about indicators that reveal information about past neighborhood externality variation. Long-term residents can much more easily build up accurate expectations about risk measures of barely visible or obvious neighborhood externalities. Thus, one can predict that in recent-mover-sample estimates, the risk measures of the less visible or obvious externalities (that is, neighborhood noise and neighborhood crime) have a relatively stronger quantitative impact on homeownership in the specification that assumes backward-looking evaluation of neighborhood externality risk. Table 7 (recent-mover-sample estimates) and table A2 (quantitative effects) confirm this prediction.

neighborhood has a major accumulation. Such a specification assumes that the influence of the variable on the homeownership status of properties is linear. Instead, the two regressions were estimated using dummy variables for each possible expression in each of the four corresponding survey questions for the four neighborhood externality level variables. The coefficients and significance levels of the four risk measures — as well as of all other variables — are virtually unaffected by the specification of the neighborhood externality level measures.

(v) Traditional Demographic Variables

All traditional explanatory variables have the expected effect on homeownership. Specifically, household income, category-dummy variables that describe the average age of adults in the household, and dummy variables that equal 1 if the housing unit includes families, married couples, children, a Black household head, or a household head with previous residence abroad all have the expected and statistically significant effect on the probability that a unit is owner-occupied.[24] Moreover, a comparison of the results for 1985 and 1999 confirms the sociological changes in the United States during the corresponding time period. In particular, marital status lost importance for the housing tenure decision although it remained highly significant statistically.

(vi) Controlling for Housing Type

Linneman (1985) suggests that relative landlord production efficiency strongly affects the homeownership status of properties. Production efficiency may derive, for example, from maintenance cost efficiency, superior credit ratings, or the ability to solve free-rider problems. Particularly in multi-unit buildings, landlord production costs are expected to be substantially lower than in single, detached houses. The regressions in table 2 include two dummy variables that control for relative landlord production efficiency. The first dummy variable equals 1 if the housing unit is a multi-unit building and 0 otherwise. The second dummy variable equals 1 if the housing unit is a single detached house and 0 otherwise. The housing type turns out to be very important in determining the homeownership status of properties. The coefficients of both dummy variables have the expected sign and are statistically significant at the 1 percent level. Not surprisingly, the results of the marginal analysis suggest that statistically a housing unit in a multi-unit building is highly likely to be renter-occupied, while a single detached house is likely to be owner-occupied.[25]

[24] See table A1 in the Appendix for a detailed description of the explanatory variables used in the empirical analysis.
[25] The estimated marginal effects and elasticities for dummy variables report the discrete change in the probability.

(vii) Controlling for MSA-Level and Center City Unobservable Characteristics

The two regressions in table 2 contain various location-specific dummy variables in order to control for MSA-level and center city unobservable characteristics. The regression results confirm that the effect of neighborhood externality risk on the homeownership status of properties is not due to unobservable characteristics that differ among MSAs. Including the MSA controls has only a very minor effect on the results. The coefficient of the dummy variable that describes the center city status of a property is not statistically significant in the regression for 1985 and only statistically significant at the 5 percent level for 1999. Furthermore, the marginal analysis suggests that, *ceteris paribus*, units in center city places only have a 1.8 percent (1985) or 3.0 percent (1999) lower probability of homeownership than their suburban or rural counterparts. Overall, these results imply that traditional homeownership models that additionally include neighborhood externality risk measures explain the very low homeownership rates in center cities quite well. The housing literature may not have to rely on some peculiar intrinsic preferences of center city residents in order to explain the "phenomenon" of particularly low homeownership rates in inner cities. The next subsection examines to what extent the omission of neighborhood externality risk affects the statistical and quantitative significance of the center city dummy variable.

B. Results of Estimates that Exclude Neighborhood Externality Risk

In the next step, the base regression is re-estimated without the four neighborhood externality risk measures.[26] With two important exceptions, the coefficients and standard errors of the explanatory variables are virtually unaffected by the omission of neighborhood-specific risk.

The first exception concerns the center city dummy variable. Compared to the specification that includes neighborhood externality risk measures, the coefficient of the center city dummy variable is about twice the size and becomes statistically significant at the 1 percent level in the regressions for 1985 and 1999. The marginal effects increase from -.011 to -.023 for 1985 and from -.020 to -.028 for 1999. This result confirms that neighborhood externality risk may be an important — and so far overlooked — determinant in explaining the very low homeownership rates of many center city neighborhoods.

The second exception concerns the neighborhood externality level variables. All but a few of the coefficients have a negative sign and become statistically significant at the 1 percent level.[27]

[26] The regression results are not reported in the paper but are available from the author upon request.

The effects on homeownership of the externalities junk, litter, and trash, as well as street noise and neighborhood noise, increase significantly compared to those in table 2. For example, an increase of the externality junk, litter, and trash by one standard deviation reduces the probability of homeownership by 4.1 percent for 1985 compared to 1.2 percent in the corresponding regression in table 2 and by 2.0 percent compared to 0.1 percent for 1999. Overall, a comparison of the results suggests that the neighborhood externality risk measures — rather than the corresponding level variables — affect the probability that a unit is owner-occupied. A model that includes neighborhood externality level variables but omits the corresponding risk measures may overestimate the effect of the level variables on homeownership.

C. Results of Estimates that Control for the Turnover Frequency within a Housing Unit

Individual perceptions of neighborhood amenities are arguably the most appropriate measures for the purpose of this study because individual assessments are the basis for location and housing tenure decisions. However, the individual assessment of neighborhood amenities also raises potential concerns about measurement error. A potentially serious concern is that neighborhood externality variation might result from household alterations within the same unit. A new household head might assess neighborhood amenities differently than his or her predecessor and this might create variation even though the neighborhood amenities were unchanged. The fact that more household alterations might result in measurement of higher neighborhood externality risk is a serious concern because tenants typically have much lower relocation costs than owners do and thus are much more likely to move. Consequently, there might be a measurement error in the risk variables that is correlated with the homeownership status of properties. Table 4 reports correlations between the neighborhood externality risk measures and the turnover frequency measured as the probability that a household moved within two years during the period between 1985 and 1999.[28] Results are shown separately for the samples of homeowners and tenants. Overall, the results mitigate the concern of a strong correlation. With one exception, the correlation

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[27] The coefficient on neighborhood noise remains insignificant in the regression for 1999. The coefficient on neighborhood crime remains positive but becomes statistically insignificant in both regressions.

[28] Because relatively few units have mover data for all survey years, a turnover probability is used rather than an absolute turnover frequency between 1985 and 1999. The turnover probability is calculated as the number of observed moves (several potential moves within two years have to be treated as one move) divided by the total number of potential moves minus the number of missing values. Thus, the variable equals 1 if the surveyed unit changed occupants at least once every two years.

coefficients have a positive sign but are relatively weak and statistically insignificant in the renter sample.

TABLE 4
Correlations between Risk Measures and Probability of Turnover

Correlation Matrix	Probability of Turnover Within 2 Years (Based on Time Period between 1985 and 1999)	
	Homeowner Sample	Renter Sample
Std. dev. of junk, litter, trash 1985-1999	.0362 **	-.0391 *
Std. dev. of street noise, 1985-1999	.0855 **	.0184
Std. dev. of neighborhood noise, 1985-1999	.0406 **	.0228
Std. dev. of neighborhood crime, 1985-1999	.0442 **	.0270

Notes: The two samples for homeowners and tenants include all housing units that did not change homeownership status between 1985 and 1999 and are included in base regressions for 1985 and 1999 (table 2). The sample size is 9,228 for the homeowner sample and 3,792 for the tenant sample. The correlations look very similar if all available housing units from the AHS are included. ** Indicates significance at the 1 percent level and * indicates significance at the 5 percent level.

The turnover frequency of the unit was not included as an explanatory variable in the base regressions in table 2 because the variable is expected to be endogenous. However, because the turnover frequency within a unit might cause some neighborhood externality variation (even though the true level of neighborhood externalities was stable over time), the base regressions in table 2 were re-estimated including the turnover probability as a control variable. The empirical model is as follows:

$$\Pr(OWN_i = 1) = f(NER_i, NE_i, Demogr._i, Housing\ Type_i, Location\ Controls_i, Pr(Move)_i), \qquad (3)$$

where $Pr(Move)_i$ is the probability of a turnover in the ith housing unit within a two-year period measured between 1985 and 1999.

Table 5 reports regression results for 1985 (Regression III) and 1999 (Regression IV). Table 6 reports the results of the marginal analysis for the focal risk variables. The sample sizes of the two regressions are the same as in table 2. Thus, the results are directly comparable. The percentage of correct homeownership status predictions is slightly than the ones in the regressions on table 2. The estimates for 1985 and 1999 predict 87.5 percent and 87.8 percent of the housing tenures correctly.

TABLE 5
Binary Logit Estimate of Homeownership Status Controlling for
Turnover Probability in Unit, 1985 and 1999

Independent Variables	Regression III: 1985		Regression IV: 1999		
	Parameter Estimates	Robust Std. Err.	Parameter Estimates		Robust Std. Err.
Intercept	1.98 **	.070	1.71 **		.09
Std. dev. of junk, litter, trash 85-99	-.44 **	.069	-.68 **		.076
Std. dev. of street noise, 85-99	-.084	.045	-.20 **		.051
Std. dev. of neigh. noise, 85-99	-.23 **	.10	-.38 **		.11
Std. dev. of neigh. crime, 85-99	-.053	.039	-.14 **		.046
Two or more unit building	-2.84 **	.064	-2.40 **		.072
Unit is a single detached house	.52 **	.055	.70 **		.059
Unit is in center city	-.084	.044	-.11 *		.055
Household income (in '000)	.022 **	.0011	.014 **		.00082
20 ≤ av. age of adults<25	-1.51 **	.080	-1.25 **		.12
25 ≤ av. age of adults<30	-.92 **	.053	-.68 **		.070
40 ≤ av. age of adults<45	.0030	.067	.11		.064
45 ≤ av. age of adults<55	.10	.059	.18 **		.059
55 ≤ av. age of adults<65	.33 **	.058	.54 **		.079
Family	.064	.057	.29 **		.061
Married couple	.52 **	.049	.32 **		.053
Children	-.67 **	.045	-.20 **		.052
Ethnicity is Black	-.48 **	.057	-.45 **		.066
Previous residence outside US	-1.16 **	.19	-.59 **		.20
Junk, litter, trash in neighborhood	-.069	.038	.045		.053
Street noise	-.071 **	.022	-.090 **		.028
Neighborhood noise	-.029	.072	.057		.13
Neighborhood crime	.033	.022	.044		.031
Probability of turnover within 2 y.	-2.95 **	.070	-3.35 **		.087
MSA dummies	Yes		Yes		
Number of observations	37,690		25,287		
Log-likelihood	-11,642		-7,617		

Notes: Dependent variable: 1 if unit is owner-occupied, 0 if unit is rented. ** Indicates significance at the 1 percent level, * indicates significance at the 5 percent level. Standard errors are robust standard errors using the Huber/White-sandwich estimator of variance. The logit model for 1985 (1999) contains 143 (144) MSA dummies that are not reported individually in the table. Percent of correct predictions = 87.5 percent (1985) and = 87.8 percent (1999), where a 0.5 threshold was used.

The turnover probability variable has a negative sign and is strongly statistically significant in the regressions for 1985 and 1999. The impact of the variable on the statistical and quantitative significance of the four neighborhood externality risk measures is quite different for each risk measure and year.

TABLE 6
Marginal Analysis for Risk Measures Using the Regressions
That Control for Turnover Probability

	Risk Measures (Std. Dev., 85-99)	Marginal Effects	Mean	Std. Dev.	Elasticity	Quantitative Effects
Regression III *1985*	Junk, litter, and trash	-.088 **	.28	.31	-.037 **	-4.1% **
	Street noise	-.017	.56	.47	-.014	-1.2%
	Neighborhood noise	-.047 **	.13	.21	-.0092 **	-1.5% **
	Neighborhood crime	-.011	.54	.54	-.0088	-.9%
Regression IV *1999*	Junk, litter, and trash	-.13 **	.31	.30	-.045 **	-5.7% **
	Street noise	-.037 **	.52	.49	-.029 **	-2.7% **
	Neighborhood noise	-.070 **	.12	.20	-.012 **	-2.1% **
	Neighborhood crime	-.027 **	.51	.54	-.020 **	-2.1% **

Notes: ** Indicates significance at the 1 percent level, * indicates significance at the 5 percent level. The marginal effects and elasticities are calculated at the means of the independent variables. Quantitative effects are measured as the percentage change of the probability of homeownership as a reaction to the change of one specific risk variable by one standard deviation.

The addition has a relatively minor effect on the statistical and quantitative significance of the risk measures in the specification for 1999 (Regression IV). The quantitative significance of the risk measure for junk, litter, and trash even increases slightly. An increase of one standard deviation in the risk measure for junk, litter, and trash reduces the probability of homeownership by 5.7 percent. On the other hand, the statistical and quantitative significance of some of the risk measures in the specification for 1985 are strongly affected by the inclusion of the turnover probability variable. The quantitative effect of the risk measure for street noise is about one-third of its previous value and remains statistically significant only at the 7 percent level. Furthermore, the risk measure for neighborhood crime is divided about in half and is no longer statistically significant. Overall, the results in table 6 confirm the quantitatively and statistically significant effect of neighborhood externality risk on the probability of homeownership. In particular, junk, litter, and trash — the risk measure with the largest quantitative effect — remains statistically significant as well as quantitatively meaningful in regressions for 1985 and 1999.

D. Results of Recent-movers Sample Estimates

The regressions in tables 2 and 5 include non-recent-mover units in the sample. However, non-recent-movers might not be on their housing demand curves (in equilibrium). This is because moving is costly, so households do not adjust to marginal changes in housing demand. Households

that have lived in a unit for several years typically have high transaction costs because the psychic costs of leaving friends and relatives behind are added to other relocation costs (such as the direct costs of moving and brokerage costs). These households might not move even though certain explanatory variables of the tenure choice (*e.g.*, income and age) are changing significantly. Consequently, if the explanatory variables evolve stochastically over time, there will be a measurement error problem that becomes more severe over time. Hence, as the explanatory variables are measured with error, one can expect that the coefficient estimates will be biased toward zero with the magnitude of the bias increasing over time. These arguments are consistent with several housing demand studies that show higher income elasticities for recent-mover samples that for non-recent-movers (*e.g.*, Harmon, 1988). The above insights are also the standard rationale for the following empirical model, which includes only recent-mover units:

$$\Pr(OWN_i = 1 \,|\, MY \leq 2) = f(NER_i,\ NE_i,\ Demogr._i,\ Hous.\ Type_i,\ Location\ Contr._i,\ Pr(Move)_i), \quad (4)$$

where *MY* describes the number of years since the current resident moved into the unit.

Table 7 reports logit estimates for the recent-mover samples for 1985 (Regression V) and 1999 (Regression VI). Table 8 reports the results of the marginal analysis for the four risk measures. Because of the exclusion of non-recent-mover units, the two sample sizes for 1985 and 1999 are about three times smaller compared to the ones in tables 2 and 5. Otherwise, the empirical models are identical to the ones in table 5. That is, the recent-mover-sample estimates also control for the turnover probability of a unit.

The percentage of correct homeownership status predictions is notably smaller than the estimates that are based on the full sample of housing units. The recent-mover-sample estimate for 1985 predicts 84.7 percent correctly; the estimate for 1999 predicts 83.1 percent correctly. Overall, the coefficients of the explanatory variables have the expected sign and — with a few exceptions — are also statistically significant.

The results for the neighborhood externality risk measures are mixed. The coefficients of all four risk measures have the expected negative sign. However, only the measure for junk, litter, and trash is statistically significant at the 1 percent level in both regressions. The measure for street noise is statistically significant only at the 8 percent level for 1985 and the 5 percent level for 1999. The measure for neighborhood noise is statistically significant at the 1 percent level for 1999 but not significant for 1985. Finally, the risk measure for neighborhood crime, the least visible or obvious externality, is not statistically significant in either of the regressions.

TABLE 7

Binary Logit Estimate of Homeownership Status for Recent-mover Units
Controlling for Turnover Probability, 1985 and 1999

Independent Variables	**Regression V: 1985**			**Regression VI: 1999**		
	Parameter Estimates		Robust Std. Err.	Parameter Estimates		Robust Std. Err.
Intercept	.95	**	.11	.82	**	.14
Std. dev. of junk, litter, trash, 85-99	-.57	**	.11	-.81	**	.12
Std. dev. of street noise, 85-99	-.13		.072	-.18	*	.079
Std. dev. of neigh. noise, 85-99	-.15		.17	-.61	**	.18
Std. dev. of neigh. crime, 85-99	-.022		.062	-.095		.069
Two or more unit building	-2.69	**	.10	-2.19	**	.11
Unit is a single detached house	-.011		.081	.69	**	.085
Unit is in center city	-.14		.072	-.18	*	.082
Household income (in '000)	.029	**	.0016	.011	**	.0012
20 ≤ av. age of adults<25	-.49	**	.089	-.89	**	.12
25 ≤ av. age of adults<30	-.18	**	.070	-.40	**	.088
40 ≤ av. age of adults<45	-.17		.12	.014		.11
45 ≤ av. age of adults<55	.093		.11	.067		.11
55 ≤ av. age of adults<65	.14		.13	.80	**	.16
Family	-.020		.10	.17		.10
Married couple	.56	**	.081	.42	**	.087
Children	-.39	**	.070	-.17	*	.081
Ethnicity is Black	-.51	**	.11	-.47	**	.11
Previous residence outside US	-.65	*	.27	-.64	**	.25
Junk, litter, trash in neighborhood	-.094		.064	.14		.090
Street noise	-.032		.036	-.17	**	.049
Neighborhood noise	-.12		.12	.22		.21
Neighborhood crime	.046		.038	.0081		.052
Prob. of turnover within 2 y.	-3.02	**	.12	-2.23	**	.13
MSA dummies	Yes			Yes		
Number of observations	12,027			8,230		
Log-likelihood	-4,214			-3,096		

Notes: A unit is considered as a recent-mover unit if the current resident moved in within the last two years. Dependent variable: 1 if unit is owner-occupied, 0 if unit is rented. ** Indicates significance at the 1 percent level, * indicates significance at the 5 percent level. Standard errors are robust standard errors using the Huber/White-sandwich estimator of variance. The logit model for 1985 (1999) contains 139 (131) MSA dummies that are not reported individually in the table. For 1985 (1999) 5 (12) MSA dummy variables that predict the outcome "owner-occupied" or "renter-occupied" perfectly were dropped, and 30 (47) observations were not used. Percent of correct predictions = 84.7 percent (1985) and = 83.1 percent (1999), where a .5 threshold was used.

This may be because recent movers have much less information about neighborhood crime than do households that have known the neighborhood for a long time and therefore are able to evaluate the level of neighborhood crime reliably.

Consistent with the results of other housing studies, the quantitative effects of the risk measures are generally much higher in the recent-mover-sample estimates than in estimates based on the full sample of housing units.[29] Specifically, table 8 reveals that an increase of the (statistically significant) risk measure for junk, litter, and trash by one standard deviation reduces the probability of homeownership by 8.1 percent for 1985 and 12.3 percent for 1999. This is about twice the size of the quantitative effects compared to the results of the full sample estimates. The magnitude of the street noise risk measure is 4.7 percent for 1999 and the magnitude of the neighborhood noise risk variable is 6.6 percent for 1999.

TABLE 8
Marginal Analysis for Risk Measures Using Recent-Mover, Unit-Sample Regressions

	Risk Measures (Std. Dev., 85-99)	Marginal Effects	Mean	Std. Dev.	Elasticity	Quantitative Effects
Regression V *1985*	Junk, litter, trash	-.10 **	.31	.30	-.082 **	-8.1% **
	Street noise	-.022	.63	.49	-.038	-3.0%
	Neighborhood noise	-.026	.16	.22	-.011	-1.6%
	Neighborhood crime	-.0038	.62	.57	-.0066	-.6%
Regression VI *1999*	Junk, litter, trash	-.15 **	.28	.30	-.11 **	-12.3% **
	Street noise	-.034 *	.60	.51	-.056 *	-4.7% *
	Neighborhood noise	-.11 **	.15	.22	-.045 **	-6.6% **
	Neighborhood crime	-.018	.59	.57	-.028	-2.7%

Notes: ** Indicates significance at the 1 percent level, * indicates significance at the 5 percent level. The marginal effects and elasticities are calculated at the means of the independent variables. Quantitative effects are measured as the percentage change of the probability of homeownership as a reaction to the change of a specific risk variable by one standard deviation.

At first glance, these magnitudes appear quite remarkable. However, the results have to be interpreted with some caution. Edin and Englund (1991) list several arguments why samples based on recent movers may give rise to misleading results. First, looking only at recent movers leads to

[29] Even though the coefficients of the risk measures are of similar size, the elasticities are much larger in the recent-mover regressions. This is because recent movers are typically relatively young households that are much less likely to own. Specifically, for 1985 (1999) the homeownership rate for the recent-mover sample is only 36 percent (37 percent) compared to 65 percent (67 percent) for the full AHS sample and 79 percent (79 percent) for the non-recent-mover sample. See also table A1 in the Appendix for some basic summary statistics for recent movers.

a large reduction of the sample size and is a waste of information. Second, the recent-mover hypothesis holds only if the explanatory variables follow a random walk or some other non-stationary process, but not if they evolve along a deterministic trend with additive white noise. That is, forward-looking households may move according to a life plan with deviations from this plan being relatively unimportant. If the recent-mover hypothesis were true, one would expect the equations estimated for recent movers to fit the data better because they are not subject to the noise and measurement errors in the data for households with longer duration. Furthermore, one would expect that the variance of the residuals increases in duration. Data for Edin and Englund (1991) provide strong empirical evidence against the recent-mover hypothesis. First, the fit of their recent-mover regression — measured by $\bar{R}^2$ — is much poorer than for the full sample. Second, the coefficients of some essential explanatory variables are basically zero and insignificant for recent movers. Third, they find no evidence that the full-sample estimates of the explanatory variables are biased toward zero due to measurement error. In fact, the variance of the residuals decreases in duration. This may be because the recent-mover sample estimates do not account properly for the dynamic aspects of housing demand. Overall, these results suggest that housing demand is forward-looking and that average values of the explanatory variables are better measured by looking at all households than by looking only at recent movers.

A comparison of the goodness of fit of the full sample estimates in table 5 with the goodness of fit of the recent-mover sample estimates in table 7 tends to confirm the objections made by Edin and Englund (1991). The goodness of fit — measured either as the percentage of correct predictions or as pseudo R^2 — is significantly lower in the recent-mover estimates than in the full-sample estimates.[30] This suggests that logit regressions based on the full sample may better estimate the true magnitude of the effects of neighborhood externality risk measures on homeownership.

E. Discussion of Potential Endogeneity and Causality

The previous results (tables 2 to 7) suggest that several neighborhood externality risk measures are related to the probability that a housing unit is owner-occupied. The estimated

[30] The pseudo R^2 is defined as $1 - L_1 / L_0$, where L_1 is the log likelihood of the full model and L_0 is the log likelihood of the "constant-only" model. This is simply the log likelihood on a scale where 0 corresponds to the "constant-only" model and 1 corresponds to perfect prediction. The pseudo R^2 for the full-sample estimates in table 6 is .52

coefficients of these risk measures are not only strongly statistically significant but also quantitatively meaningful. Overall, the results imply that one important determinant of the homeownership status of properties has so far been overlooked. However, the results have to be interpreted with caution. The neighborhood externality risk measures may not be exogenous. One major concern is that of reversed causality.[31] Either homeowner associations or dominant landlords may affect the neighborhood quality and possibly the variation of neighborhood externalities.

Several studies suggest that homeowners positively affect the quality of their neighborhood (*e.g.*, Galster, 1983; Rossi and Weber, 1996; Green and White, 1997; DiPasquale and Glaeser, 1999; Fischel, 2001; Hilber and Mayer, 2002). On the other hand, Linneman (1985) argues that landlords may have greater political influence and also may have relative advantages in solving a number of free-rider problems that may affect the neighborhood. While all these suggestions are plausible, the studies do not answer the question of whether the homeownership status may also affect the variation — rather than the level — of neighborhood externalities.

Essentially, only a few institutional settings are expected to be effective in reducing neighborhood externality variation. Preventive zoning, private deed restrictions, and neighborhood covenants may successfully reduce the neighborhood externality variation. These settings may be implemented without major difficulties in newly developing neighborhoods. However, established neighborhoods typically are already zoned permanently and private deed restrictions or neighborhood covenants are very hard to institute because of the difficulty in achieving unanimous agreement in the appropriate provisions.[32] Thus, the neighborhood externality variation is expected to be endogenous in newly developing neighborhoods — where most new houses are built — but may be exogenous in already established neighborhoods.

In order to confirm that the neighborhood externality risk measures are related to homeownership even if newly built housing units are excluded, the homeownership models were re-estimated using samples that exclude newly built housing units. The logit estimates for 1999 include only housing units that report neighborhood externality data since 1985. Thus, these units are all located in established neighborhoods. However, the reported logit estimates for 1985 include a significant fraction of units that were built within five years prior to 1985. In the full

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for 1985 and .53 for 1999. For the recent-mover estimates in table 7, the pseudo R^2 is .46 for 1985 and .43 for 1999.

[31] However, even if the causality were reversed or reciprocal, this would not invalidate the fact that neighborhood externality risk matters for owners of residential properties.

[32] See Hughes and Turnbull (1996) for a further discussion of these instruments.

sample, this fraction is 7.6 percent; in the recent-mover sample, it is 17.2 percent. The logit models for 1985 were re-estimated using samples that include only housing units that were built prior to 1980 and even prior to 1970. The coefficients and statistical significance levels are virtually unaffected by excluding newly constructed housing units.

One might argue that institutional settings may also be changed relatively easily in revitalizing neighborhoods. Thus, the logit models were also re-estimated for 1999, using a sample that excludes newly built housing units that may indicate revitalizing neighborhoods. However, as for 1985, the coefficients and statistical significance levels are virtually unaffected by excluding the newly constructed units. Evidently, these results are only conjecture and cannot fully address the concern of endogeneity.

The potential problem of endogeneity or reversed causality could best be addressed with an instrumental variable strategy. Unfortunately, the AHS does not provide appropriate instrumental variables that are highly correlated with the neighborhood externality risk variables but uncorrelated with the error term. As a second-best alternative to the instrumental variable approach, a causality test is suggested that analyzes the relation between housing tenure transitions and future neighborhood externality variation. The test reveals that neighborhood externality variation can explain precedent isolated housing tenure transitions. On the other hand, isolated housing tenure transitions in a neighborhood are very unlikely to affect future neighborhood externality variation. The causality test takes advantage of two particularities of housing tenure transitions. First, housing tenure transitions over a few years are mostly isolated cases. Second, relocation is costly and therefore residents are not always in perfect equilibrium.

It is plausible that homeowner associations or landlords may affect the neighborhood externality variation. However, isolated housing tenure changes are highly unlikely to affect the political and social influence of homeowner-associations and may thus fail to explain future variation of neighborhood externalities. An analysis of a particular sub-sample of the AHS — which discloses specific information about neighboring units — confirms that at least over a period of five years, housing tenure transitions are indeed fairly isolated cases, and concerted actions with respect to housing tenure changes in the same direction occur very seldom.[33] Consequently, it is

[33] The sub-sample for 1985 consists of units in 665 neighborhoods or "clusters." The average number of housing units within a cluster is 10.3. The sub-sample consists of 214 clusters (32.2 percent of all clusters) with at least one tenure change from owner-occupied in 1985 to renter-occupied in 1989. In 127 of these 214 cases (59.3 percent), the tenure change from owner-occupied to renter-occupied is an isolated event. In 79.9 percent of the cases, the probability that a random neighbor also becomes a renter-occupier is .125 or smaller. Hence, "concerted actions"

highly unlikely that housing tenure transitions over a period of five years explain future variation in neighborhood externalities. On the other hand, neighborhood externality variation is expected to explain precedent housing tenure transitions. This is because relocation is costly and therefore residents are not always in perfect equilibrium. Thus, one would expect that during a move the previous owner of a housing unit — that is, either a landlord or an owner-occupier — responds to a potential disequilibrium situation with corresponding adjustments. That is, the owner is expected to adjust the optimal homeownership status to current conditions, including the expected future neighborhood externality risk. This leads to two predictions:

Prediction 1: Housing units that are owner-occupied have a higher probability of becoming renter-occupied if the expected neighborhood externality variation is large.

Prediction 2: The probability that a renter-occupied unit becomes owner-occupied is lower in places with large expected neighborhood externality variation.

If the two predictions turned out to be true, this would provide quite compelling evidence that neighborhood externality risk indeed affects the homeownership status of properties and that the effect may be causal.

Tables 9 and 11 report binary logit estimates of homeownership status changes between 1985 and 1989. To begin with, table 9 reports binary logit estimates of the probability that a unit changes the homeownership status from owner-occupied in 1985 to renter-occupied in 1989. Prediction 1 states that the expected neighborhood externality variation (between 1989 and 1999) should positively affect the probability that a unit changes from owner-occupied to renter-occupied. Prediction 1 is tested using two different specifications of the empirical model. The first specification of the empirical model is as follows:

$$\Pr(OWN_i^{85} \rightarrow RENT_i^{89} \,|\, OWN_i^{85}) = f(NER_i^{89\text{-}99},\ \Delta NE_i^{89\text{-}99},\ X_i^{85},\ X_i^{89}), \qquad (5.1)$$

occur very seldom indeed. Only in 4.7 percent of all clusters does the probability that a random neighbor also becomes a renter-occupier exceed .3. The sub-sample also consists of 254 clusters (38.2 percent of all clusters) with at least one tenure change from renter-occupied in 1985 to owner-occupied in 1989. In 56.3 percent of the cases, the tenure change from renter-occupied to owner-occupied is an isolated event. In 72.8 percent of the cases, the probability that a random neighbor also becomes an owner-occupier is smaller than .125. In 10.2 percent of the cases, the probability exceeds .3. "Concerted actions" tend to occur more often in renter-occupier neighborhoods that transform into owner-occupier neighborhoods. However, even in these renter-occupier neighborhoods, the likelihood of "concerted actions" remains relatively small.

where $\Pr(OWN_i^{85} \rightarrow RENT_i^{89} \,|\, OWN_i^{85})$ is the probability that the i[th] housing unit changes from owner-occupied in 1985 to renter-occupied in 1989, $NER_i^{89\text{-}99}$ describes the vector of neighborhood externality risk variables (measured between 1989 and 1999), $\Delta NE_i^{89\text{-}99}$ describes the vector of neighborhood externality level changes between 1989 and 1999, and X_i^{85} and X_i^{89} are the vectors of other explanatory variables for 1985 and 1989, that is, all variables — except the neighborhood externality risk and level measures — that are included in the basic empirical model (2).

The estimate controls for the possibility that expected neighborhood externality changes between 1989 and 1999, rather than neighborhood externality variations, explain homeownership status changes. Furthermore, the estimate controls for the fact that the occupant may change between 1985 and 1989. The second specification of the empirical model also includes the turnover probability within a unit in order to control for potential variation of the risk measures caused by turnovers. Consequently, the second specification of the empirical model is as follows:

$$\Pr(OWN_i^{85} \rightarrow RENT_i^{89} \,|\, OWN_i^{85}) = f(NER_i^{89\text{-}99},\ \Delta NE_i^{89\text{-}99},\ X_i^{85},\ X_i^{89},\ Pr(Move)_i^{89\text{-}99}), \quad (5.2)$$

where $Pr(Move)_i^{89\text{-}99}$ describes the probability of a turnover in the i[th] housing unit within a two-year period measured between 1989 and 1999.

Table 9 reports logit estimates corresponding to empirical models (5.1) and (5.2). The estimates predict a very high percentage of the homeownership status changes correctly — 90.0 percent for Regression VII and 90.9 percent for Regression VIII. Because variables for 1989 were added, the sample size (4,796 observations in both regressions) is considerably smaller than the full sample for 1985 (37,690 observations) and even compared to the recent-mover sample for 1985 (12,027 observations). Due to the smaller sample size, it is less likely that any given parameter is significantly different from zero. Indeed, fewer variables are statistically significant at the 5 percent or 1 percent level. However, in most cases, the quantitative effects of these statistically significant variables are very meaningful.

Consistent with Prediction 1, all coefficients of the neighborhood externality risk variables have a positive sign in both specifications. However, only the risk measure for junk, litter, and trash is statistically significant at the 1 percent level in Regression VII and at the 5 percent level in Regression VIII. As table 10 shows, the risk measure for junk, litter, and trash is also quantitatively meaningful. Increasing the risk measure by one standard deviation increases the

probability that a unit changes from owner-occupied in 1985 to renter-occupied in 1989 by 11.6 percent according to the estimates that do not control for the turnover probability (Regression VII) and by 6.5 percent according to the estimates that include the turnover probability (Regression VIII).

TABLE 9
Binary Logit Estimates of Homeownership Status Changes
from Owner-Occupied to Renter-Occupied between 1985 and 1989

Independent Variables	**Regression VII: Excl. Turnover Prob.** Parameter Estimates	Robust Std. Error	**Regression VIII: Incl. Turnover Prob.** Parameter Estimates	Robust Std. Error
Intercept	-2.63 **	.23	-4.05 **	.28
Std. dev. of junk, litter, trash, 89-99	.63 **	.16	.47 *	.19
Std. dev. of street noise, 89-99	.18	.12	.063	.13
Std. dev. of neigh. noise, 89-99	.26	.29	.39	.32
Std. dev. of neigh. crime, 89-99	.072	.11	.068	.12
Unit is in center city	.079	.13	.088	.15
Change junk, litter, trash 89-99	-.15	.084	-.23 *	.093
Change street noise, 89-99	.012	.052	.024	.057
Change nghd noise, 89-99	.069	.18	.0016	.20
Change nghd crime, 89-99	.11 *	.054	.14 *	.059
Prob. of turnover within 2 y.			4.13 **	.23
Housing type controls	Yes		Yes	
Demographic controls for 85	Yes		Yes	
Demographic controls for 89	Yes		Yes	
MSA dummies	Yes		Yes	
Number of observations	4,796		4,796	
Log-likelihood	-1306.1		-1122.3	

Notes: Dependent variable: 1 if unit is renter-occupied in 1989, 0 if unit is still owner-occupied in 1989. The sample consists of 4796 units that are all owner-occupied in 1985. The percentage of units in the sample that are owner-occupied in 1985 and renter-occupied in 1989 is 10.3 percent. ** Indicates significance at the 1 percent level, * indicates significance at the 5 percent level. Standard errors are robust standard errors using the Huber/White-sandwich estimator of variance. The logit models for the sample contain 85 MSA dummies that are not reported individually in the table. 53 MSA dummy variables that predict the outcome "no homeownership status change" perfectly were dropped and 312 observations not used. Percent of correct predictions = 90.0 percent (Regression VII) and = 90.9 percent (Regression VIII), where a .5 threshold was used. In Regression VII 3 observations (that is, .06 percent of all observations with no missing values) were dropped in order to create a sample that is comparable with Regression VIII.

The quantitative size of the effect is quite meaningful even compared to some of the traditional explanatory variables. Several of these variables also explain homeownership status changes from owner- to renter-occupied. That is, several demographic characteristics of previous and future occupants, the housing type, location-specific characteristics turn out to be statistically and quantitatively significant in one or in both estimates. Not surprisingly, a high future turnover probability is positively related to the probability of a preceding homeownership status change from owner-occupied to renter-occupied. The effect is highly statistically significant as well as quantitatively meaningful (see table A2 in the Appendix).

TABLE 10

Marginal Analysis for Risk Measures Using Regressions XII and VIII

	Risk Measures (Std. Dev., 85-99)	Marginal Effects	Mean	Std. Dev.	Elasticity	Quantitative Effects
Regression VII *Excluding Turnover Prob.*	Junk, litter, and trash	.038 **	.23	.31	.086 **	11.6% **
	Street noise	.011	.48	.47	.052	5.0%
	Neighborhood noise	.016	.095	.19	.014	2.8%
	Neighborhood crime	.0044	.46	.51	.019	2.2%
Regression VIII *Including Turnover Prob.*	Junk, litter, and trash	.021 *	.23	.31	.048 *	6.5% *
	Street noise	.0028	.48	.47	.013	1.3%
	Neighborhood noise	.018	.095	.19	.016	3.2%
	Neighborhood crime	.0030	.46	.51	.013	1.5%

Notes: ** Indicates significance at the 1 percent level, * indicates significance at the 5 percent level. The marginal effects and elasticities are calculated at the means of the independent variables. Quantitative effects are measured as the percentage change of the probability that an owner-occupied unit becomes renter-occupied as a reaction to the change of a specific risk variable by one standard deviation.

Prediction 2 states that expected neighborhood externality risk should negatively affect the probability that a renter-occupied unit becomes owner-occupied. In analogy to Prediction 1, Prediction 2 is tested using the following two specifications:

$$\Pr(RENT_i^{85} \rightarrow OWN_i^{89} \,|\, RENT_i^{85}) = f(NER_i^{89\text{-}99},\ \Delta NE_i^{89\text{-}99},\ X_i^{85},\ X_i^{89}) \qquad (6.1)$$

$$\Pr(RENT_i^{85} \rightarrow OWN_i^{89} \,|\, RENT_i^{85}) = f(NER_i^{89\text{-}99},\ \Delta NE_i^{89\text{-}99},\ X_i^{85},\ X_i^{89},\ Pr(Move)_i^{89\text{-}99}), \qquad (6.2)$$

where $\Pr(RENT_i^{85} \rightarrow OWN_i^{89} \,|\, RENT_i^{85})$ is the probability that the i^{th} housing unit changes from renter-occupied in 1985 to owner-occupied in 1989.

Regressions IX and X in table 11 report the binary logit estimates corresponding to empirical models (6.1) and (6.2). Table 12 reports the results of the marginal analysis for the focal risk variables. The estimates are based on a sample of 4,045 observations and correctly predict 91.7 percent (Regression IX) and 92.5 percent (Regression X).

TABLE 11
Binary Logit Estimates of Homeownership Status Changes
from Renter-Occupied to Owner-Occupied between 1985 and 1989

Independent Variables	**Regression IX: Excl. Turnover Prob.** Parameter Estimates	Robust Std. Error	**Regression X: Incl. Turnover Prob.** Parameter Estimates	Robust Std. Error
Intercept	-2.41 **	.30	-1.64 **	.30
Std. dev. of junk, litter, trash 89-99	-.38	.24	-.32	.25
Std. dev. of street noise, 89-99	-.68 **	.16	-.53 **	.17
Std. dev. of neigh. noise, 89-99	-.051	.33	-.014	.34
Std. dev. of neigh. crime, 89-99	-.13	.14	-.16	.15
Unit is in center city	-.020	.15	-.0061	.16
Change junk, litter, trash 89-99	-.12	.11	-.062	.11
Change street noise, 89-99	-.075	.065	-.10	.066
Change nghd noise, 89-99	-.045	.21	-.054	.22
Change nghd crime, 89-99	.040	.061	.047	.061
Prob. of turnover within 2 y.			-2.80 **	.29
Housing type controls	Yes		Yes	
Demographic controls for 85	Yes		Yes	
Demographic controls for 89	Yes		Yes	
MSA dummies	Yes		Yes	
Number of observations	4,045		4,045	
Log-likelihood	-900.8		-839.1	

Notes: Dependent variable: 1 if unit is owner-occupied in 1989, 0 if unit is still renter-occupied in 1989. The sample consists of 4045 units that are all renter-occupied in 1985. The percentage of units in the sample that are renter-occupied in 1985 and owner-occupied in 1989 is 8.7 percent. ** Indicates significance at the 1 percent level, * indicates significance at the 5 percent level. Standard errors are robust standard errors using the Huber/White-sandwich estimator of variance. The logit models for the sample contain 78 MSA dummies that are not reported individually in the table. 64 MSA dummy variables that predict the outcome "no homeownership status change" perfectly were dropped and 398 observations not used. Percent of correct predictions = 91.7 percent (Regression IX) and = 92.5 percent (Regression X), where a .5 threshold was used.

Consistent with Prediction 2, the coefficients of all neighborhood externality risk measures have a negative sign, suggesting that increasing neighborhood externality risk reduces the

probability that a renter-occupied unit is transformed into an owner-occupied unit. However, only the risk measure for street noise is statistically significant at the 1 percent level in both regressions. The other risk measures are not statistically significant. The effect of the risk measure for street noise is also quantitatively meaningful. Increasing the risk measure by one standard deviation reduces the probability that a unit changes from renter-occupied in 1985 to owner-occupied in 1989 by 14.6 percent according to the estimates that exclude the turnover probability and by 9.1 percent according to the estimates that control for the turnover probability.

TABLE 12
Marginal Analysis for Risk Measures Using the Regressions IX and X

	Risk Measures (Std. Dev., 85-99)	Marginal Effects	Mean	Std. Dev.	Elasticity	Quantitative Effects
Regression IX *Excluding Turnover Prob.*	Junk, litter, and trash	-.015	.36	.30	-.062	-5.2%
	Street noise	-.027 **	.70	.47	-.22 **	-14.6% **
	Neighborhood noise	-.0020	.17	.23	-.0040	-.5%
	Neighborhood crime	-.0053	.70	.56	-.0426	-3.4%
Regression X *Including Turnover Prob.*	Junk, litter, and trash	-.010	.36	.30	-.042	-3.5%
	Street noise	-.017 **	.70	.47	-.13 **	-9.1% **
	Neighborhood noise	-.00044	.17	.23	-.00087	-.1%
	Neighborhood crime	-.0049	.70	.56	-.039	-3.1%

Notes: ** Indicates significance at the 1 percent level, * indicates significance at the 5 percent level. The marginal effects and elasticities are calculated at the means of the independent variables. Quantitative effects are measured as the percentage change of the probability that a renter-occupied unit becomes owner-occupied as a reaction to the change of a specific risk variable by one standard deviation.

Besides the neighborhood externality risk measure for street noise, only a few other variables have a statistically significant effect on homeownership status changes from renter- to owner-occupied. In particular, the control variable "turnover probability" is negatively related to the probability of a homeownership status change from renter- to owner-occupied. The effect is statistically significant as well as quantitatively meaningful.

While all neighborhood externality risk measures have the expected sign in all of the regressions in tables 9 and 11, only the risk measure for junk, litter, and trash and the one for street noise are statistically significant (at the 1 percent level) as well as quantitatively meaningful. This result suggests that at least two neighborhood externality risk measures may affect the probability that a housing unit changes the homeownership status. Furthermore, plausibility considerations suggest that these effects may be causal. Finally, the analysis of homeownership status changes

also confirms that the housing type and several life cycle attributes are major determinants of the homeownership status changes of properties.

F. Other Concerns Regarding the Risk Measures

Section 4 C mitigates the concern that neighborhood externality variation might result from alterations of households with different individual assessments. Another concern associated with individual assessments derives from the possibility that owner-occupants and renter-occupants may assess neighborhood amenities differently. If homeowners were less critical than tenants in assessing neighborhood amenities, this might explain why neighborhood externality level or risk measures are negatively related to the homeownership status of properties. In order to address this concern, a sub-sample of the AHS for 1985, which discloses information on individual assessments of amenities by homeowners and tenants of the same neighborhood, is examined. The assessment of the junk, litter, and trash variable serves as a point of reference because in 1985, unbiased Census field representatives assessed the junk, litter, and trash in the neighborhood. On average, the interviewers were slightly more likely to critically assess junk, litter, and trash in front of a renter-occupied unit than in front of an owner-occupied unit in the same neighborhood.[34] This translates into higher risk measures for renter-occupied units. In 40 percent of the neighborhoods, the average risk assessment is larger for renter-occupied units; in 22.5 percent, the average risk assessment is identical; and in 37.5 percent of the neighborhoods, the average risk assessment is smaller for renter-occupied units. On the other hand, owner-occupiers are more critical than renter-occupiers in assessing the other three neighborhood externalities, which translates into higher risk measures for owner-occupied units. The percentage value ratios are 33:17:50 (variation in street noise), 43:3:54 (variation in neighborhood noise), and 45:6:50 (variation in neighborhood crime). These results imply that the coefficients of the risk measures for street noise, neighborhood noise, and neighborhood crime are biased against finding an effect. Furthermore, these results may explain why the (unbiased) risk measure for junk, litter, and trash has the strongest statistical and quantitative effect on the homeownership status of properties.

Finally, one might be concerned that virtually all housing units with high neighborhood externality variation are concentrated in distressed neighborhoods, while all housing units with no variation are concentrated in very good neighborhoods. Table 13 reports the percentage of housing units in "top" neighborhoods (highest quality) and distressed neighborhoods (very low quality) for

three degrees of neighborhood externality risk (no variation, moderate variation, and very high variation) for 1985 and 1999. As one might predict intuitively, distressed neighborhoods have a far higher percentage of units with very high neighborhood externality risk and a far lower percentage of units with no neighborhood externality variation in the relevant period between 1985 and 1999. However, table 13 also documents that a rather high percentage of units in distressed neighborhoods have no neighborhood externality variation, while a significant fraction of units in top neighborhoods have a very high variation.

TABLE 13

Neighborhood Externality Variation in Top and Distressed Neighborhoods

		Units with very high variation in %				Units with Moderate variation in %				Units with no variation in %			
Type of Externality:		Junk, litter	Street noise	Nghd noise	Nghd crime	Junk, litter	Street noise	Nghd noise	Nghd crime	Junk, litter	Street noise	Nghd noise	Nghd crime
1985	Top Nghd	7.7	5.5	6.8	4.7	31.2	55.3	12.2	42.6	61.1	39.2	81.0	52.7
	Distressed Nghd	18.8	23.5	25.0	25.0	54.6	60.4	22.1	52.2	26.6	16.1	52.9	22.8
1999	Top Nghd	6.7	5.3	5.8	5.2	25.3	44.8	11.3	35.7	68.0	49.9	82.9	59.1
	Distressed Nghd	24.1	23.5	21.4	25.9	46.4	59.2	21.7	50.3	29.5	17.3	56.9	23.8

Notes: "Very high" neighborhood externality variation is defined as variation that is in the top 10 percent percentile. "Moderate" variation is any variation greater than zero and below the top 10 percent percentile. A unit is defined as a unit in a "top neighborhood" if the valuation of neighborhood quality is 10 out of 10 possible points. A unit is defined as a unit in a "distressed neighborhood" if the valuation of neighborhood quality is lower than 6 out of 10 possible points. For 1985 14,395 units were in top neighborhoods and 5,566 units distressed neighborhoods, which reflects 38.4 percent (14.8 percent) of the total number of units in the base regression samples. For 1999 5,595 units were in top neighborhoods and 2,956 units in distressed neighborhoods, which reflects 22.1 percent (11.7 percent) of the total number of units in the base regression samples.

5 Conclusions

This paper argues that owner-occupied housing typically causes a portfolio distortion for single owner-occupiers. This distortion increases with housing investment risk and, in particular, with the corresponding neighborhood externality risk. Thus, increasing neighborhood externality risk makes owner-occupied housing relatively less attractive and less likely than renter-occupied housing. *Ceteris paribus*, neighborhood-specific differences in the externality risk measures

[34] This result may reflect the different treatment of properties by owner-occupiers versus renter-occupiers.

should affect the probability that a housing unit in a specific neighborhood is owner-occupied. The empirical evidence presented supports this proposition strongly and suggests that the relationship may be causal.

The reported neighborhood externality risk measures typically are higher in center city places and in distressed neighborhoods. The logit models presented suggest that neighborhood externality risk measures explain roughly half of the previously unexplained effect of unobservable center-city-specific characteristics on the homeownership status of properties. The dummy variable for units in center city places is no longer statistically significant in several of the reported regressions after neighborhood externality risk measures and housing type controls are taken into account. Thus, the housing literature may not have to rely on peculiar preferences of center city residents for renter-occupied housing. Second, high neighborhood externality risk may partly explain the particularly low homeownership rates and — because of tenants' moral hazard problems — the decay of buildings in many inner city neighborhoods. Thus, neighborhood externality risk may indirectly be a significant cause for the decay of neighborhoods.

In fact, there have been attempts in the Chicago area to insure homeowners against property value reductions caused by neighborhood influences (*e.g.*, Shiller and Weiss, 1999). The most prominent attempt is the Chicago "home equity assurance program," whose main political goal has been to prevent "panic peddling" and thereby avoid the further outflow of responsible residents. So far, however, neither this program nor other attempts by local governments in the Chicago area have been successful in dealing with the moral hazard and the selection bias problem. Shiller and Weiss (1999) propose modifications involving a real estate price index that might deal better with the problem of moral hazard, but none of these modifications have yet been implemented. The findings in this paper suggest that the most crucial modification proposed by Shiller and Weiss — the real estate price index — ought to be neighborhood-specific in order to be implemented successfully.

There are a number of possible directions for future research. Given the fact that homeownership and avoiding neighborhood decay are considered the most desirable goals politically, one could further focus on institutional settings that may avoid neighborhood externality risk initially. Institutional settings such as deed restrictions and neighborhood covenants may help to create stability in newly developing neighborhoods and may thereby encourage homeownership in these places. In established neighborhoods, one could focus on mechanisms that insure against the risk subsequently.

The methodology used in this paper can also be used for related research questions. For example, Chicago's home equity assurance program has been most popular in predominantly white areas that face uncertain future ethnicity mixes. One might therefore expect that neighborhood-specific uncertainty about the future ethnicity mix is another significant determinant of residential properties' homeownership status. Measures of ethnic uncertainty can be evaluated on the neighborhood level and can then be used to examine the influence of ethnic uncertainty on homeownership status. Obviously, such a study will have to take into account the literature on discrimination in residential-mortgage lending (*e.g.*, Munnell *et al*, 1996; Ladd, 1998), particularly the issue of "geographic redlining," that is, lenders' denying loans to an area because it has a large proportion of minority residents or because it is poor and rundown.[35]

A last possible expansion of the research concerns this mortgage lending decision and the potential discrimination against minorities in mortgage lending. Neighborhood-specific risks are expected to affect the rate of return on a loan, but mortgage lenders may not be able to fully price neighborhood-specific risks into mortgage interest rates. Hence, they may have incentives to completely avoid locations with high neighborhood-specific risks. The previous literature on discrimination in mortgage lending and redlining suggests that lenders generally discriminate not on the basis of the property's location, but rather on the basis of the applicant's race (*e.g.*, Ladd, 1998). However, previous studies use only rough proxies for neighborhood-specific risks. In contrast, the measures of neighborhood externality risk used in this paper are direct measures of neighborhood-specific risks. Future work will therefore address whether mortgage originators take neighborhood-specific housing investment risk into account when deciding whether to grant or deny credit. Better controls for neighborhood-specific risks may also affect the statistical and quantitative significance of measures of discrimination against minorities. Finally, credit denial may affect different categories of investors (*e.g.*, single owner-occupiers or private developers) in different ways. However, even if it were true that neighborhood-specific risk measures affect the lending decision and thereby the homeownership status of properties, the fact remains that neighborhood externality risk is an important — and thus far overlooked — determinant of homeownership, and the main conclusions of this paper still hold.

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[35] One theoretical explanation for the redlining phenomenon is statistical discrimination in conjunction with sorting (*e.g.*, Ladd, 1998). Stiglitz and Weiss (1981) provide an alternative explanation why true credit rationing is used in markets with imperfect information in lieu of full-marginal-cost pricing of higher-risk loans. In their framework, the phenomenon of redlining originates from the fact that prices may have sorting and incentive effects.

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Appendix

TABLE A1
Variable List and Summary Statistics

Variable	# Obs.	Mean	Std. Dev.	Minimum	Maximum
Homeownership Status Variables					
Homeownership dummy, 1985	37690			0	1
Homeownership dummy, 1999	25287			0	1
Housing Structure Type, Overall Unit and Neighborhood Quality, Probability of Turnover within Unit					
One-unit detached house dummy, 1985	37690			0	1
One-unit detached house dummy, 1999	25287			0	1
Two or more units building dummy, 1985	37690			0	1
Two or more unit building dummy, 1999	25287			0	1
Overall housing unit quality, 1985 †	37541			1	10
Overall housing unit quality, 1999 †	25115			1	10
Overall neighborhood quality, 1985 †	37459			1	10
Overall neighborhood quality, 1999 †	25016			1	10
Prob. of turnover within 2 y. (85-99), 85	37690			0	1
Prob. of turnover within 2 y. (85-99), 99 †	25287			0	1
Household-specific Information					
Household income, 1985	37690	2864	2412	0	264600
Household income, 1999	25287	6191	5743	0	774424
Ethnicity of household head is Black, 1985	37690			0	1
Ethnicity of household head is Black, 1999	25287			0	1
Family lives in unit, 1985	37690			0	1
Family lives in unit, 1999	25287			0	1
Married couple lives in unit, 1985	37690			0	1
Married couple lives in unit, 1999	25287			0	1
One or more children live in unit, 1985	37690			0	1
One or more children live in unit, 1999	25287			0	1
Previous residence outside US, 1985	37690			0	1
Previous residence outside US, 1999	25287			0	1
Average age of adults in unit, 1985	37690			18	91
Average age of adults in unit, 1999	25287			18	93
General Location-specific Variables					
Center city dummy, 1985	37690			0	1
Center city dummy, 1999	25287			0	1
Unit is inside MSA, 1985	37690			0	1
Unit is inside MSA, 1999	25287			0	1
General Recent-Mover Information ††					
Homeownership dummy, 85, recent movers	12027			0	1
Homeownership dummy, 99, recent movers	8230			0	1
Av. age of adults in unit, 1985, recent movers	12027			18	91
Av. age of adults in unit, 1999, recent movers	8230			18	93

Notes: The variable list and summary statistics are based on the base regression- and recent-mover regression-samples. † These samples are slightly smaller than the regression samples because some housing units included in the regression have no information about the overall unit or neighborhood quality. †† Units are only included in the sample if the current household head moved in within the last two years.

TABLE A1 — *Continued*
Variable List and Summary Statistics

Variable	Based on Base Regression Sample for 1985			Based on Base Regression Sample for 1999				
	# Obs.	Mean	Std. Dev.	# Obs.	Mean	Std. Dev.	Minimum	Maximum
Neighborhood Externality Risk Variables (Standard Deviations)								
Std. dev. of junk, litter, 85-99	37690	0.2762	0.3070	25287	0.2406	0.3036	0	1.4142
Std. dev. of street noise, 85-99	37690	0.5608	0.4737	25287	0.5179	0.4893	0	2.1213
Std. dev. of neigh. Noise, 85-99	37690	0.1287	0.2057	25287	0.1173	0.2006	0	.7071
Std. dev. of neigh. Crime, 85-99	37690	0.5419	0.5378	25287	0.5075	0.5371	0	2.1213
Neighborhood Externality Level-Variables								
Junk, litter, in neighborhood, 85	37690	0.3059	0.5238	17899	0.2771	0.5009	0	2
Junk, litter in neighborhood, 87	19304	0.3233	0.5316	12052	0.2858	0.5072	0	2
Junk, litter in neighborhood, 89	18915	0.3213	0.5340	9613	0.2780	0.5048	0	2
Junk, litter in neighborhood, 91	16474	0.2952	0.5091	10656	0.2570	0.4804	0	2
Junk, litter in neighborhood, 93	19514	0.3034	0.5214	11896	0.2419	0.4785	0	2
Junk, litter in neighborhood, 95	16547	0.2939	0.5161	15233	0.2295	0.4678	0	2
Junk, litter in neighborhood, 97	28235	0.1348	0.4215	20930	0.1200	0.3984	0	2
Junk litter in neighborhood, 99	28017	0.1302	0.4156	25287	0.1175	0.3939	0	2
Street noise in neighborhood, 85	37690	0.5998	0.9136	15523	0.5942	0.9183	0	3
Street noise in neighborhood, 87	30526	0.5933	0.9074	17304	0.5729	0.9010	0	3
Street noise in neighborhood, 89	33868	0.5991	0.9160	17768	0.5690	0.9058	0	3
Street noise in neighborhood, 91	29141	0.5777	0.9104	18456	0.5506	0.9075	0	3
Street noise in neighborhood, 93	32771	0.5978	0.9293	19136	0.5576	0.9137	0	3
Street noise in neighborhood, 95	27203	0.5627	0.9054	21853	0.5456	0.9076	0	3
Street noise in neighborhood, 97	26082	0.5001	0.8329	19915	0.4668	0.8247	0	3
Street noise in neighborhood, 99	26004	0.4830	0.8303	25287	0.4682	0.8330	0	3
Neighborhood noise, 85	37690	0.0790	0.2698	9613	0.2780	0.5048	0	2
Neighborhood noise, 87	30447	0.0713	0.2573	16040	0.0773	0.2671	0	1
Neighborhood noise, 89	33587	0.0749	0.2633	17562	0.0742	0.2621	0	1
Neighborhood noise, 91	28911	0.0768	0.2662	18230	0.0771	0.2668	0	1
Neighborhood noise, 93	32429	0.0858	0.2801	18894	0.0807	0.2724	0	1
Neighborhood noise, 95	26984	0.0783	0.2687	21662	0.0822	0.2747	0	1
Neighborhood noise, 97	26153	0.0263	0.1602	19949	0.0270	0.1621	0	1
Neighborhood noise, 99	25970	0.0285	0.1665	25287	0.0289	0.1676	0	1
Neighborhood crime, 85	37690	0.4024	0.8689	15497	0.3741	0.8400	0	3
Neighborhood crime, 87	30459	0.3842	0.8367	17264	0.3719	0.8222	0	3
Neighborhood crime, 89	33806	0.4606	0.9054	17735	0.4389	0.8835	0	3
Neighborhood crime, 91	29050	0.4823	0.9253	18403	0.4712	0.9176	0	3
Neighborhood crime, 93	32709	0.4991	0.9451	19093	0.4750	0.9239	0	3
Neighborhood crime, 95	27118	0.4573	0.9077	21796	0.4599	0.9114	0	3
Neighborhood crime, 97	25958	0.3374	0.7961	19848	0.3212	0.7765	0	3
Neighborhood crime, 99	25841	0.2790	0.7334	25287	0.2831	0.7327	0	3

Variable	Based on Housing Units that are included in both Base Regression Samples for 1985 and 1999				
	# Obs.	Mean	Std. Dev.	Minimum	Maximum
Changes in Homeownership Status and Neighborhood Externalities between 1985 and 1999					
Housing tenure change, 85-99	14943	-0.0045	0.3587	-1	1
Probability of turnover, 85-99	14943	0.2381	0.2666	0	1
Change in junk, litter, 85-99	14943	-0.1502	0.5809	-2	2
Change in street noise, 85-99	14943	-0.1108	1.0680	-3	3
Change in neigh. noise, 85-99	14943	-0.0493	0.3102	-1	1
Change in neigh. crime, 85-99	14943	-0.0881	1.0223	-3	3

TABLE A1 — *Continued*
Variable List and Summary Statistics

Variable	Based on Ownership Status Change-Regression, 1985 Initial Homeowner-Sample			Based on Ownership Status Change-Regression, 1985 Initial Renter-Sample				
	# Obs.	Mean	Std. Dev.	# Obs.	Mean	Std. Dev.	Minimum	Maximum
Homeownership Status Change Variables								
Change Owner → Tenant, 85-89	4796	0.1030	0.3040				0	1
Change Tenant → Owner, 85-89				4045	0.0873	0.2823	0	1
Neighborhood Externality Risk Variables (Standard Deviations of Level Variables between 1989 and 1999)								
Std. dev. of junk, litter, 89-99	4796	0.2339	0.3147	4045	0.3558	0.2986	0	1.4142
Std. dev. of street noise, 89-99	4796	0.4831	0.4688	4045	0.6995	0.4742	0	2.1213
Std. dev. of neigh. noise, 89-99	4796	0.0946	0.1851	4045	0.1710	0.2260	0	0.7071
Std. dev. of neigh. crime, 89-99	4796	0.4556	0.5125	4045	0.6986	0.5576	0	2.1213
Changes in Neighborhood Externality Levels between 1989 and 1999								
Change in junk, litter, 89-99	4796	-0.1172	0.5638	4045	-0.1758	0.6749	-2	2
Change in street noise, 89-99	4796	-0.0917	0.9986	4045	-0.1424	1.2146	-3	3
Change in neigh. noise, 89-99	4796	-0.0373	0.2801	4045	-0.0865	0.3773	-1	1
Change in neigh. crime, 89-99	4796	-0.1591	0.9694	4045	-0.2316	1.2615	-3	3
Household-specific Information for 1985 and 1989								
Household income, 1985	4796	31956.8	25491.7	4045	20011.9	17478.7	0	236801
Household income, 1989	4796	36988.3	29617.6	4045	23738.8	20110.7	0	262500
Family lives in unit, 1985	4796	0.7882	0.4087	4045	0.5876	0.4923	0	1
Family lives in unit, 1989	4796	0.7688	0.4217	4045	0.5763	0.4942	0	1
Married couple lives in unit, 1985	4796	0.6797	0.4666	4045	0.3889	0.4876	0	1
Married couple lives in unit, 1989	4796	0.6393	0.4803	4045	0.3538	0.4782	0	1
One or more children in unit, 1985	4796	0.3768	0.4846	4045	0.3740	0.4839	0	1
One or more children in unit, 1989	4796	0.3816	0.4858	4045	0.3946	0.4888	0	1
Ethnicity of hh. head is Black, 1985	4796	0.0865	0.2812	4045	0.1459	0.3530	0	1
Ethnicity of hh. head is Black, 1989	4796	0.0995	0.2993	4045	0.1629	0.3693	0	1
Prev. residence outside US, 1985	4796	0.00459	0.0676	4045	0.0178	0.1322	0	1
Prev. residence outside US, 1989	4796	0.00375	0.0612	4045	0.0124	0.1105	0	1
Average age of adults in unit, 1985	4796	48.43	16.88	4045	39.47	17.44	18	91
Average age of adults in unit, 1989	4796	48.21	17.19	4045	39.51	16.89	18	91
Turnover Frequency within Unit (Measured between 1989 and 1999)								
Probability of turnover within 2 y.	4796	0.1495	0.2178	4045	0.4297	0.3210	0	1

TABLE A2

Percentage Change of Dependent Variable as Reaction to an Increase of Independent Variable by One Standard Deviation

	Table 2: Basic		Table *2 — Excl. Risk*		Table 5: Incl. Pr(Move)		Table 7: Recent Movers		Table 9: Pr(Own->Rent)		Table 11: Pr(Rent->Own)	
Independent Variables	I (85)	II (99)	(85)	(99)	III (85)	IV (99)	V (85)	VI (99)	VII (ePT)	VIII (iPT)	IX (ePT)	X (iPT)
Std. dev. junk, litter, 89-99	-5.0%**	-5.4%**			-4.1%**	-5.7%**	-8.1%**	-12.3%**	11.6%**	6.5%*	-5.2%	-3.5%
Std. dev. street noise, 89-99	-3.6%**	-3.8%**			-1.2%	-2.7%**	-3.0%	-4.7%*	5.0%	1.3%	-14.6%**	-9.1%**
Std. dev. nghd noise, 89-99	-2.0%**	-2.5%**			-1.5%**	-2.1%**	-1.6%	-6.6%**	2.8%	3.2%	-.5%	-.1%
Std. dev. nghd crime, 89-99	-2.0%**	-2.3%**			-.9%	-2.1%**	-.6%	-2.7%	2.2%	1.5%	-3.4%	-3.1%
Two or more unit building	-40.4%**	-30.5%**	-40.7%**	-30.3%**	-39.2%**	-28.4%**	-63.6%**	-54.8%**	22.9%**	19.2%**	-28.7%**	-20.8%**
Unit is a single det. House	11.3%**	14.2%**	11.8%**	12.8%**	7.6%**	9.2%**	-.2%	17.2%**	4.9%	8.3%*	12.4%**	7.5%*
Unit is in center city	-.8%	-1.4%*	-1.7%**	-1.9%**	-1.2%	-1.4%*	-3.3%	-4.4%*	2.1%	1.7%	-.5%	-.1%
Household income, 85	15.5%**	22.0%**	16.5%**	23.2%**	16.4%**	21.4%**	31.0%**	26.2%**	5.4%	4.8%	3.8%	4.2%*
Household income, 89									-20.9%**	-17.2%**	18.5%**	16.0%**
20 ≤ av. age adults<25, 85	-13.7%**	-10.3%**	-14.1%**	-10.4%**	-11.1%**	-7.5%**	-8.6%**	-15.4%**	2.2%	2.1%	-4.6%	-2.5%
20 ≤ av. age adults<25, 89									19.2%**	11.8%**	-3.7%	1.1%
25 ≤ av. age adults<30, 85	-11.1%**	-8.4%**	-11.3%**	-8.4%**	-9.1%**	-5.6%**	-3.7%**	-8.1%**	5.9%*	3.6%	.7%	2.1%
25 ≤ av. age adults<30, 89									16.7%**	9.8%**	-5.3%	-1.0%
40 ≤ av. age adults<45, 85	.8%	1.9%**	.7%	2.1%**	.0%	1.1%	-1.9%	.2%	-1.5%	-.1%	.4%	-1.1%
40 ≤ av. age adults<45, 89									2.6%	2.9%	1.2%	1.7%
45 ≤ av. age adults<55, 85	2.1%**	4.6%**	2.1%**	4.8%**	1.0%	2.0%**	1.1%	1.1%	3.2%	4.2%	-1.0%	-1.3%
45 ≤ av. age adults<55, 89									-3.4%	-1.9%	.5%	.1%
55 ≤ av. age adults<65, 85	4.7%**	8.3%**	4.8%**	8.0%**	3.3%**	4.9%**	1.5%	8.6%**	-9.4%*	-4.9%	-2.1%	-1.7%
55 ≤ av. age adults<65, 89									-11.5%*	-6.2%	7.7%**	4.4%
Family, 85	2.6%**	7.3%**	2.4%**	6.7%**	.9%	3.7%**	-.4%	4.2%	-17.8%**	-13.3%**	13.0%*	7.0%
Family, 89									-5.6%	-.1%	-.5%	-.7%
Married couple, 85	8.4%**	2.7%**	8.7%**	3.3%**	7.8%**	4.5%**	13.2%**	10.3%**	11.8%*	10.4%*	-7.6%	-4.9%
Married couple, 89									-14.2%**	-10.0%**	12.7%**	8.5%**
Children, 85	-10.6%**	-3.8%**	-11.0%**	-3.9%**	-9.8%**	-2.7%**	-9.1%**	-4.0%*	-5.7%	-3.5%	-2.8%	-.1%
Children, 89									33.8%**	25.2%**	-.2%	.0%
Ethnicity is Black, 85	-3.2%**	-3.2%**	-3.7%**	-3.6%**	-4.4%**	-3.8%**	-7.4%**	-7.6%**	-10.3%	-4.3%	7.0%	6.6%
Ethnicity is Black, 89									-.7%	.2%	-13.8%**	-13.2%**
Prev. resid. outside US, 85	-3.6%**	-3.4%**	-3.6%**	-3.3%**	-3.1%**	-1.8%**	-3.7%*	-5.2%*	5.4%*	3.2%*	-3.5%	-2.9%
Prev. resid. outside US, 89									5.9%**	3.5%*	-2.6%	-.3%
Junk, litter in neighborhood	-1.2%	.1%	-4.1%**	-2.0%**	-1.1%	.5%	-2.4%	3.1%				
Street noise	-1.4%*	-1.2%	-3.5%**	-3.4%**	-2.0%**	-2.1%**	-1.4%	-7.3%**				
Neighborhood noise	-.4%	.2%	-1.3%**	-.6%	-.2%	.3%	-1.7%	2.0%				
Neighborhood crime	1.3%*	1.8%**	.3%	.7%	.9%	.9%	2.0%	.3%				
Change junk, litter, 89-99									-5.0%	-5.7%*	-3.6%	-1.5%
Change street noise, 89-99									.7%	1.1%	-4.1%	-4.5%
Change nghd noise, 89-99									1.1%	.0%	-.8%	-.7%
Change nghd crime, 89-99									6.4%*	5.8%*	2.3%	2.2%
Prob. of turnover within 2 y.					-26.0%**	-27.1%**	-47.3%**	-32.5%**		39.2%**		-29.2%**

Notes: ** Indicates significance at the 1 percent level, * indicates significance at the 5 percent level. Probability of turnover is measured between 1985 and 1999 for tables 4 to 7 and between 1989 and 1999 for tables 8 and 9. The abbreviation "ePT" ("iPT") stands for excluding (including) the variable "probability of turnover within two years."