Neighborhood Externality Risk
and
The Homeownership Status of Properties

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Abstract

In contrast to corporate and institutional investors with larger asset portfolios, single owner-occupiers cannot adequately diversify real estate risk. They therefore pay a risk premium that increases with the corresponding risk. Ceteris paribus, homeownership should be relatively less attractive in places with higher real estate risk. Using the American Housing Survey, it is documented that neighborhood externality risk, a major component of real estate risk, substantially reduces the probability that a housing unit is owner-occupied, having controlled for 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 and 12.3 percent. An analysis of units that change their homeownership status suggests that this effect may be causal.

1 Introduction

Many center city neighborhoods have very little social capital, low quality schools, and suffer from substantial juvenile crime problems. Recent studies suggest that homeownership benefits social capital (e.g., Rossi and Weber 1996, DiPasquale and Glaeser 1999) and provides a better environment for the upbringing of children (Green and White 1996). Places with high homeownership rates may also have better control over local government (Fischel 2001) and more investment in good quality schools as long as the places have inelastic land supply (Hilber and Mayer 2002). Due to these interactions, it is essential first to understand why homeownership rates are so low in many urban neighborhoods.

The previous housing literature has mainly focused on household specific characteristics as determinants of the individual homeownership decision.[1] However, research about the role of location specific factors as determinants of the homeownership status of properties is a widely underdeveloped area. For example, it is still not fully understood why inner cities have much lower homeownership rates than suburban and rural places.[2] 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 or even between metropolitan statistical areas (MSAs) but barely within MSAs. In particular, user costs should not vary significantly between neighborhoods and, thus, fail to explain cross-sectional differences in homeownership rates between neighborhoods. Linneman (1985) points out that dense neighborhoods—with high rises rather than single-family homes—have higher relative landlord production efficiency and therefore lower homeownership rates. Another potentially important but frequently overlooked location factor is neighborhood specific housing risk, that is, neighborhood externality risk. This paper tests the influence of such neighborhood externality risk on the ownership status of residential properties.

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[1] 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) and race (e.g., Kain and Quigley 1972, Gyourko *et al.* 1999, Painter *et al*. 2000) are major determinants of the housing tenure choice (i.e., the decision whether to own or rent the home).

[2] This phenomenon can be partially explained by segregation of households with different characteristics. Segregated groups may have different 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 uncertainty about future income. However, all these determinants fail to fully explain why homeownership rates are so extremely low in inner cities and 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.

The contribution of the paper to the literature is twofold. First, a literature review in Section 2 summarizes the basic mechanisms through which neighborhood externality risk is expected to affect the homeownership status of properties. The basic proposition—which is founded on the literature that followed Henderson and Ioannides (1983)—states that typically risk averse households have to "overinvest" in housing due to an investment constraint induced by owner-occupied housing. Thus, in contrast to risk neutral investors[3], the constrained owner-occupier households cannot adequately diversify their portfolios. Since 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 owning.

Second, the empirical section tests this proposition using housing unit specific data from the American Housing Survey (AHS) and provides strong evidence that neighborhood externality risk variables—directly measured as the standard deviation of four specific kinds of negative neighborhood externalities between 1985 and 1999—are negatively related to the probability of owning, even after controlling for the level of the externalities, the housing type, center city- and MSA-level unobservable characteristics. The results of the logit estimates suggest that, ceteris paribus, potential homebuyers—in contrast to corporate and institutional investors with larger asset portfolios—avoid neighborhoods with high externality risk. This outcome is robust towards the inclusion or exclusion of other variables that potentially explain the homeownership status of properties. The effects of some neighborhood externality risk measures on homeownership are not only significant in a statistical but also in a quantitative sense. Quantitative effects are measured as the percentage change of the probability of homeownership as a reaction to the change of the explanatory variable by one standard deviation. Consistent with theory, the risk variables of the most visible externalities—junk and litter and street noise—have the strongest negative effect on homeownership. For the full sample estimates the quantitative effects of the statistically significant neighborhood externality risk measures range from 1.5 to 5.7 percent, depending on the type of externality and model specification. Recent mover sample estimates even document much larger quantitative effects.[4] For example, a decrease of the neighborhood externality risk measure for junk

[3] Corporate investors may be considered as "risk neutral". This is because shareholders of investment companies can adequately diversify their portfolio by holding shares of companies with differing risk-return compositions. Furthermore, corporate and institutional investors with larger asset portfolios can adequately diversify the involved investment risk.

[4] The rationale behind recent mover sample estimates is discussed in detail in Section 4.

and litter by one standard deviation increases the probability of owning by 8.1 percent for 1985 and by 12.3 percent for 1999. The magnitude of the effects is 1.7 to 3.1 times smaller for the full sample estimates compared to those that are based on recent mover units only. However, the fit of the recent mover estimates is poorer, and therefore, the magnitude of the effects may be better estimated by the estimates that include all housing units.

The empirical findings suggest that neighborhood externality risk may provide an alternative explanation for why homeownership rates are so low in many urban areas. A dummy variable for center city unobservable characteristics is about divided in half if neighborhood externality risk measures are included. In fact, the center city dummy is no longer statistically significant in many of the reported estimates.

Finally, the empirical section also addresses the endogeneity and causality issues, that is, the concerns that the neighborhood externality risk measures might be endogenously determined and that the homeownership status affects the neighborhood externality risk measures rather then the other way round. Unfortunately, the AHS does not provide appropriate instrumental variables for the neighborhood externality risk measures. However, an analysis of changes in the ownership status of residential properties provides evidence that a reversed causality is rather unlikely. The paper concludes with a brief discussion of the results and policy implications.

2 Uncertainty, Investment Decisions, and Homeownership Status

This paper tests the influence of neighborhood externality risk (i.e., the variation in neighborhood externalities over time) rather than housing risk (i.e., the variation in house prices over time) on the homeownership status of properties. However, neighborhood externality risk is similar to housing risk if neighborhood externalities are capitalized into house values. Although it is quite intuitive that neighborhood externalities affect property values, the empirical evidence of earlier studies that use disaggregated data is weak mainly due to measurement problems with regard to neighborhood quality and misspecification. More recent studies however, overcome these problems using alternative approaches and indeed provide strong evidence for capitalization of neighborhood quality and externalities into house values (e.g., Grieson and White 1989, Dubin 1992).[5] In a related study, Furman Speyrer (1989) provides empirical evidence that single owner-

[5] 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

occupiers in Houston pay house price premiums for zoning and restrictive covenants that reduce neighborhood uncertainty. Hence, neighborhood externality risk is expected to be a significant component of housing risk.

The influence of risky housing on the tenure choice is the subject of several theoretical and empirical studies. The theoretical studies typically assume that owner-occupied housing involves both a consumption choice and a portfolio decision. In a seminal theoretical paper, Henderson and Ioannides (1983) develop a housing investment-consumption model that provides a basis for analyzing housing demand and tenure choice. The key element of their model is an investment constraint that requires that homeowners must own at least as much housing as they consume.[6] 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. Thus, an increase in investment risk enlarges the distortion associated with owner-occupied housing.[7] This makes homeownership relatively more costly and reduces the probability that households own their home.[8] 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

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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 quality and externalities into house values.

6 This is due to the absence of partial-ownership arrangements that are typically considered to be unfeasible.

7 This distortion potentially increased by the fact that most homeowners strongly leverage their investments in owner-occupied housing.

8 Fu (1995) states more precisely that this result does not necessarily hold in the presence of a liquidity constraint and that the net impact of a change in house price uncertainty on the optimal housing investment cannot be determined theoretically. A further analysis of the data used in the empirical section of this paper sheds some light on Fu's (1995) proposition. Several additional logit estimates—besides the ones reported in this paper—were carried out. However, neither specifications with interaction terms nor specifications that split the sample with regard to income provide any empirical evidence that the liquidity constraint may mitigate or even offset the negative influence of housing uncertainty on the probability of owning. These results—and all other results that are not reported as tables in the paper—are available from the author upon request

binding, homeowners cannot adequately diversify their portfolio. They therefore have to pay a risk premium that increases with the corresponding risk.[9]

On the empirical side, Goetzmann (1993) provides apparent 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 (1993) shows that, for a given return, large portfolios of residential properties are much less risky than an investment in one single home. The recent empirical literature on risk and housing tenure focuses on income uncertainty (e.g., Haurin 1991, Robst *et al.* 1999) and rent risk (e.g., Sinai and Souleles 2001). These studies all report significant effects of risk on housing tenure. For example, Robst *et al.* (1999) use several measures of income uncertainty to reexamine the empirical relationship between income uncertainty and housing tenure. Their results indicate that income uncertainty reduces the likelihood of households to own their homes. Sinai and Souleles (2001) consider uncertainty of renting rather than risk associated with owner-occupied housing. They argue that with renting, the long-term cost of obtaining housing is unknown. Thus, owner-occupied housing should provide a rent insurance benefit. Their empirical results indicate that the rent insurance benefit of owning significantly increases the homeownership rate. Finally, Fishback (1992) provides historical evidence of coal company towns that also strongly supports the hypothesis that real estate risk affects the homeownership status of properties. 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 real estate risk: The miners faced substantial risk of capital losses of their houses. Because they typically had small wealth they were not able to adequately diversify the involved real estate risk and consequently preferred to rent their homes.

The previous theoretical and empirical work described above implies that potential homebuyers should be discouraged to purchase properties in places with high housing risk—such as many inner city neighborhoods. In order to empirically test this prediction on a disaggregated level one would need reliable individual housing risk data. Unfortunately, such data—that is, the variation of true individual house prices over time—hardly exists. This is because housing units are

[9] Brueckner (1997) further notes that while the optimal portfolio of a single owner-occupier is inefficient in a mean-variance sense, this does not indicate that households are irrational in their financial decisions. Rather, it is the result of a rational balancing of the consumption benefits and the portfolio distortion induced by homeownership.

typically sold only rarely, and therefore, for most time periods no reliable individual house price data is available that would allow researchers to calculate the price variation of a specific housing unit. However, as argued above, the same theoretical considerations and predictions that apply for housing risk also apply for neighborhood externality risk. That is, after controlling for everything else, one expects that housing units are more likely to be owner-occupied in neighborhoods with low rather than high neighborhood externality risk.[10] In particular, high neighborhood externality risk may partially explain why homeownership rates or so low in inner cities. The prediction that neighborhood externality risk affects the homeownership status of properties is tested empirically using periodical data from the American Housing Survey (AHS) between 1985 and 1999. In the section below, the data used in the empirical analysis is described in detail. Section 4 then examines the major hypothesis that the externality risk of a specific neighborhood negatively affects the probability that a unit in that neighborhood will be owner-occupied.

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).[11] In particular, the set of neighborhood specific variables includes four neighborhood externality level-variables: Junk, litter and trash in the

[10] In a world with mobile households and a large number of jurisdictions this does not imply that households will become tenants in order to avoid the distortions associated with owner-occupied housing in risky neighborhoods. Rather, it is likely that potential homebuyers with strong preferences for owner-occupied housing avoid certain neighborhoods that they might have chosen otherwise. That is, neighborhood externality risk may affect the individual location choice rather than the individual tenure choice. A model that tries to simultaneously estimate the individual location decision and tenure choice goes beyond the scope of this paper. The goal of this paper is merely to demonstrate that neighborhood externality risk affects the homeownership status of properties.

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

neighborhood, street noise in the neighborhood, neighborhood noise and neighborhood crime.[12] These variables were obtained from the interviewed households by asking them to value the quality of several neighborhood specific characteristics.[13] One exception is the variable "junk, litter, and trash in the neighborhood". 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.[14]

Very particular housing units are excluded from the sample. That is, the data set excludes units that are mobile or vacant. In addition, units that are occupied by households that do not pay a market rent are also excluded from the sample.

Several tables report summary statistics that shed more light on the data used in the empirical analysis. To begin with, 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 may be due to changes in economic conditions such as the economic boom in the 1990s or due to changes in the way the survey is conducted.[15] However, these differences between certain years either affect all units in the same way or are captured by the MSA-dummy variables that control for potential differential changes of economic conditions between different metropolitan areas.[16]

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[12] 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).

[13] Individual perceptions may be the most appropriate measures for the purpose of this analysis as the occupants themselves are the ones who make the joint location and tenure decision.

[14] Standard deviations of the neighborhood externality variables were also created for units with missing values for certain years.

[15] According to the "Documentation of Changes in the 1997 American Housing Survey" the change in data collection (computerization), 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 differences of the means for the "junk and litter"-variable in 1997 and 1999 compared to earlier years (see Table A1 in the Appendix). The reason is that prior to 1997 single-unit structures were visited only when a phone interview was not possible. Consequently, single-unit structures have more missing values in the years prior to 1997. Because multi-unit structures typically are in neighborhoods with more junk and litter in the street the reported means for the "junk and litter"-variable are higher prior to 1997.

[16] The binary logit models presented in Section 4 were also re-estimated using adjusted neighborhood externality risk measures to confirm that the correlations between neighborhood externality risk measures and the housing tenure

Table 1 reports the percentage of units that had either 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 of 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 and litter in neighborhood	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 (for each specific neighborhood externality) include all housing units that are included in both base-regressions for 1985 and 1999 (Table 4) and have no missing neighborhood externality-observations in the AHS surveys between 1985 and 1999. The results (distributions) are virtually the same compared to those that include all available housing units from the AHS with no missing observations.

Because the respondents rather than the interviewers evaluate three of the four neighborhood externalities, a further concern is that neighborhood externality variation might result from household alterations within the same unit. A new household head might assess the neighborhood characteristics differently than his or her predecessor and this might create variation. Thus, the fact that a unit has more household alterations might result in higher neighborhood externality risk values. This is a serious concern because tenants typically move much more frequently than owners. Consequently, there might be a measurement error in the risk variables that is correlated with the homeownership status of properties. Table 2 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.[17] Results are

variable are not caused by potential changes in the way the survey is conducted. That is, 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.

[17] Because relatively few units have mover-data for all 8 survey years (85, 87, 89, 91, 93, 95, 97, 99) 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 2 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 observed a change of occupancy at least once between two survey years for all survey years with no missing observations.

shown for the samples of homeowners and tenants separately. Overall, the results mitigate the concern of a strong correlation between the turnover frequency and the risk variables. With one exception the correlation coefficients have a positive sign but are relatively weak and even statistically insignificant in the renter-sample. Furthermore, in the renter sample the risk measure for junk and litter even has a negative (and statistically significant) correlation coefficient.

TABLE 2
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 and litter, 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 the homeownership status between 1985 and 1999 and are included in both base-regressions for 1985 and 1999 (Table 4). The sample size is 9228 for the homeowner-sample and 3792 for tenant-sample. The correlations look very similar if all available housing units from the AHS are included. ** Indicates significance at the 1 percent level, * indicates significance at the 5 percent level.

However, even though the correlations between the turnover probability and the four neighborhood externality risk measures are weak, a correlation matrix per se cannot invalidate the concern of measurement error. Therefore, the turnover probability is included as a control variable in several of the logit estimates in section 4. The addition of such a control variable has a minor negative or even a slightly positive effect on the quantitative and statistical significance of certain risk measures but has a strong diminishing effect on the quantitative and statistical significance of other risk measures. The addition of the turnover probability into the logit estimates and the results are discussed in detail in Section 4 *C*.

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 3 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 time period between 1985 and 1999. However, Table 3 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 has a very high variation.

TABLE 3
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 Neighborhoods	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 Neighborhoods	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 Neighborhoods	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 Neighborhoods	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 a variation that is in the top 10% percentile. "Moderate" variation is any variation greater than zero and below the top 10% 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% (14.8%) 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% (11.7%) of the total number of units in the base-regression samples.

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):

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

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 estimating equation in more detail.

[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 towards the choice of the estimator.

A. Basic Estimating Equation and Results

(i) Basic Estimating Equation of the 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 estimating equation 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 estimating equation is as follows:

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

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

Table 4 reports marginal effects[19] and elasticities of each explanatory variable—calculated at the means of the independent variables—in addition to the coefficients and robust standard errors.[20] 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 homeownership status are measured for 1985. Thereby, it is assumed that households have perfect foresight in assessing neighborhood externality risk.

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

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[19] 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.

[20] 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.

TABLE 4
Binary Logit Estimate of the Homeownership Status (Base-Regression), 1985 and 1999

	Regression I: 1985						**Regression II: 1999**					
			Marginal Analysis						Marginal Analysis			
Independent Variables	Parameter Estimates	Robust Std. Err.	Marginal Effects	Mean	Std. Dev	Elast.	Parameter Estimates	Robust Std. Err.	Marginal Effects	Mean	Std. Dev.	Elast.
Intercept	1.18**	.063					.30**	.074				
Std. dev. of junk/litter, 85-99	-.53**	.066	-.11**	.28	.31	-.045**	-.62**	.071	-.12**	.24	.30	-.042**
Std. dev. of street noise, 85-99	-.25**	.042	-.050**	.56	.47	-.043**	-.27**	.048	-.052**	.52	.49	-.040**
Std. dev. of neigh. noise, 85-99	-.31**	.094	-.062**	.13	.21	-.012**	-.45**	.11	-.084**	.12	.20	-.015**
Std. dev. of neigh. crime, 85-99	-.12**	.037	-.024**	.54	.54	-.020**	-.15**	.044	-.028**	.51	.54	-.022**
Two or more unit building	-2.92**	.060	-.58**	.29	.45	-.26**	-2.51**	.067	-.47**	.24	.43	-.17**
Unit is a single detached house	.76**	.052	.15**	.63	.48	.15**	1.05**	.054	.20**	.64	.48	.19**
Unit is in center city	-.057	.042	-.011	.36	.48	-.0063	-.10*	.052	-.020*	.31	.46	-.0094*
Household income	2.1E-05**	1.1E-06	4.2E-06**	28648	24125	.18**	1.4E-05**	8.1E-07	2.6E-06**	61916	57438	.24**
20 ≤ av. age of adults<25	-1.86**	.073	-.37**	.062	.24	-.035**	-1.68**	.10	-.32**	.049	.22	-.023**
25 ≤ av. age of adults<30	-1.10**	.049	-.22**	.12	.33	-.041**	-.99**	.064	-.19**	.10	.30	-.028**
40 ≤ av. age of adults<45	.091	.063	.018	.09	.29	.0025	.19**	.061	.036**	.15	.35	.0080**
45 ≤ av. age of adults<55	.22**	.056	.044**	.11	.32	.0076**	.40**	.056	.076**	.21	.41	.024**
55 ≤ av. age of adults<65	.47**	.056	.094**	.12	.33	.018**	.91**	.074	.171**	.12	.33	.031**
Family	.19**	.054	.038**	.72	.45	.042**	.57**	.057	.107**	.70	.46	.11**
Married couple	.56**	.046	.11**	.58	.49	.10**	.19**	.050	.036**	.48	.50	.026**
Children	-.71**	.043	-.14**	.37	.48	-.082**	-.28**	.049	-.054**	.34	.48	-.028**
Ethnicity is black	-.35**	.054	-.069**	.10	.31	-.011**	-.36**	.063	-.069**	.11	.31	-.011**
Previous residence outside USA	-1.32**	.20	-.26**	.0079	.089	-.0032**	-1.09**	.19	-.20**	.013	.11	-.0039**
Junk/litter in neighborhood	-.072	.037	-.014	.31	.52	-.0068	.013	.052	.0024	.12	.39	.00042
Street noise	-.050*	.021	-.010*	.60	.91	-.0091*	-.049	.027	-.009	.47	.83	-.0065
Neighborhood noise	-.049	.069	-.0098	.079	.27	-.0012	.036	.12	.007	.029	.17	.00030
Neighborhood crime	.049*	.021	.010*	.40	.87	.0061*	.088**	.030	.017**	.28	.73	.0070**
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 marginal effects and elasticities are calculated at the means of the independent variables. 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% (1985) and = 86.4% (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 and Table 6.

The neighborhood externality level variables—junk and litter in the neighborhood, 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 influence the homeownership status. The vector of explanatory variables also includes several traditional household-specific variables such as age, household income, family status, marital status, immigration status and ethnicity. Only household wealth is not included because the data is not available from the AHS.[21] Two variables describe the housing type. These variables control for relative landlord production efficiency differences as described by Linneman (1985). Finally, the basic estimating equation 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.

(ii) General Regression Results

The estimated logit models strongly confirm the expected negative influence of the neighborhood externality risk measures on the probability of owning. 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 two logit-regressions for 1985 and 1999 predict 86.5 percent and 86.4 percent of the actual housing tenures correctly. Hence, the prediction of the homeownership status of a housing unit is quite accurate in both regressions.

[21] One can expect that other household specific variables—in particular household income and average age of household members—may proxy reasonably well for household wealth. Nevertheless, the exclusion of household wealth is a serious 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. However, the imputed wealth variables are not particularly well identified, as the available variables in the AHS that potentially explain wealth are also likely to be related to the housing tenure. With this caveat, several additional logit estimates for 1999 were carried out using the imputed wealth variables. The coefficient on imputed wealth is always positive and strongly significant. However, the coefficients and statistical significance levels of the four neighborhood externality risk measures change remarkably little with the inclusion of imputed wealth. The lack of change in the neighborhood externality risk measures contrasts with the observation that estimated effects of some demographic variables (e.g., income) become considerably smaller.

(iii) Influence of Neighborhood Externality Risk

In both logit models for 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 owning. 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 suggest a quite strong effect of certain neighborhood externality risk measures on the 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 by 5.4 percent in the regression for 1999.[22] The magnitudes of the effects of the other neighborhood externality risk measures on the homeownership status of the units are somewhat smaller. An increase of the risk measure for street noise by one standard deviation reduces the probability of ownership by 3.6 percent (1985) and 3.8 percent (1999) respectively. An increase of the neighborhood noise variation by one standard deviation reduces the ownership-probability by 2.0 percent (1985) and 2.5 percent (1999) respectively. Finally, the ownership-probability is reduced by 2.0 (2.3) percent if the variation of neighborhood crime is increased by one standard deviation in the regression for 1985 (1999). Overall, the risk measures of the more "visible" externalities (junk, litter, and trash and street noise) have a far stronger quantitative negative impact on the ownership status of residential properties than the less visible externalities (neighborhood noise and neighborhood crime). This result suggests, that the more visible externalities are either of more concern to the residents or can be better evaluated.[23]

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[22] Using the values reported in Table 4, this percentage is calculated as the standard deviation of the risk measure divided by the mean and multiplied with 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. Table A2 in the Appendix reports quantitative effects for all reported explanatory variables.

[23] If the neighborhood externalities are barely visible 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 neighborhood externalities.

(iv) Controlling for Neighborhood Externality Levels

The regressions in Table 4 include variables that measure the levels of the neighborhood externalities. Potential homebuyers might have relatively stronger preferences for low levels of neighborhood externalities compared to potential new tenants. To the extent that the neighborhood externality risk measures are related to the corresponding neighborhood externality level variables, the omission of the level variables could thus 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 and the coefficient on the variable "neighborhood crime" is statistically significant at the 5 percent level for 1985 and at the 1 percent level for 1999. Interestingly enough, the coefficient on the latter variable is positive in both specifications. 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. An increase of 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 comparison with a regression that excludes neighborhood externality level variables demonstrates that the coefficients and standard errors of the variables that measure the neighborhood externality risks are virtually unaffected by the inclusion of the neighborhood externality level variables.

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 minor accumulation and it equals 2 if the neighborhood has 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

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Thus, one can predict that in recent mover sample-estimates the risk measures of less visible 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.

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, the marital status lost importance for the housing tenure decision although it remained highly statistically significant.

(vi) Controlling for Housing Type

Linneman (1985) suggests that the relative landlord production efficiency strongly affects the homeownership status of properties. Relative landlord production efficiency may derive, for example, from maintenance cost efficiency, superior credit ratings, or the ability of solving 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 4 include two dummy variables that control for relative landlord production efficiency. The two dummy variables equal 1 if the housing unit is in a multi-unit building or in a single detached house respectively. 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 it is highly likely that a housing unit in a multi-unit building is 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 4 contain a specific dummy variable for each MSA in the sample in order to control for potential user cost differences or other MSA-level unobservable characteristics. Because of the large number of MSAs in the sample—143 in 1985 and 144 in 1999—the coefficients of the MSA-dummies are not reported individually. Although some of the MSA dummy variables are strongly statistically significant in both specifications, regressions that exclude these MSA dummy variables show that they have no significant effect on the coefficients of all other variables including the neighborhood externality risk variables. This result confirms that the effect of neighborhood externality risk on the homeownership status of properties is not due to unobservable characteristics that differ between MSAs.

The Regressions I and II also contain a dummy variable that describes the center city status. The variable equals 1 if the unit is located in a center city, and 0 otherwise. The coefficient 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 compared to 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 neighborhood externality risk affects the statistical and quantitative significance of the center city dummy variable.

B. Results of Estimates that Exclude Neighborhood Externality Risk

Table 5 includes neighborhood externality level variables but excludes the four neighborhood externality risk measures in order to test the influence of the omission of these variables. The estimating equation is as follows:

$$\Pr(OWN_i = 1) = f(NE_i, Demographics_i, Housing\ Type_i, Location\ Controls_i). \qquad (3)$$

TABLE 5

Binary Logit Estimate of Homeownership Status (Excluding Neighborhood Externality Risk Variables), 1985 and 1999

	Regression III: 1985						**Regression IV: 1999**					
			Marginal Analysis						Marginal Analysis			
Independent Variables	Parameter Estimates	Robust Std. Err.	Marginal Effects	Mean	Std. Dev	Elast.	Parameter Estimates	Robust Std. Err.	Marginal Effects	Mean	Std. Dev.	Elast.
Intercept	.90**	.058					-.070	.068				
Two or more unit building	-2.92**	.059	-.59**	.29	.45	-.26**	-2.53**	.066	-.47**	.24	.43	-.17**
Unit is a single detached house	.79**	.051	.16**	.63	.48	.15**	1.09**	.053	.18**	.64	.48	.17**
Unit is in center city	-.11**	.042	-.023**	.36	.48	-.013**	-.19**	.051	-.028**	.31	.46	-.013**
Household income	2.2E-05**	1.1E-06	4.5E-06**	28648	24125	.20**	1.5E-05**	8.2E-07	2.7E-06**	61916	57438	.25**
20 ≤ av. age of adults<25	-1.90**	.073	-.38**	.062	.24	-.036**	-1.73**	.10	-.32**	.049	.22	-.024**
25 ≤ av. age of adults<30	-1.12**	.049	-.23**	.12	.33	-.042**	-1.00**	.064	-.19**	.10	.30	-.028**
40 ≤ av. age of adults<45	.084	.062	.017	.089	.29	.0023	.19**	.060	.039**	.15	.35	.0087**
45 ≤ av. age of adults<55	.21**	.056	.043**	.11	.32	.0075**	.40**	.056	.079**	.21	.41	.025**
55 ≤ av. age of adults<65	.48**	.056	.096**	.12	.33	.018**	.91**	.074	.164**	.12	.33	.029**
Family	.18**	.054	.035**	.72	.45	.039**	.54**	.057	.098**	.70	.46	.10**
Married couple	.57**	.046	.11**	.58	.49	.10**	.22**	.050	.044**	.48	.50	.032**
Children	-.74**	.042	-.15**	.37	.48	-.085**	-.31**	.048	-.055**	.34	.48	-.028**
Ethnicity is black	-.39**	.054	-.079**	.10	.31	-.013**	-.45**	.062	-.077**	.11	.31	-.012**
Previous residence outside USA	-1.32**	.20	-.27**	.0079	.089	-.0032**	-1.12**	.18	-.20**	.013	.11	-.0037**
Junk/litter in neighborhood	-.25**	.032	-.051**	.31	.52	-.024**	-.16**	.050	-.0332**	.12	.39	-.0058**
Street noise	-.12**	.019	-.025**	.60	.91	-.023**	-.14**	.025	-.027**	.47	.83	-.019**
Neighborhood noise	-.16**	.062	-.0326**	.079	.27	-.0039**	-.15	.12	-.023	.029	.17	-.00099
Neighborhood crime	.010	.020	.002	.40	.87	.0012	.036	.029	.006	.28	.73	.0027
MSA dummies	Yes						Yes					
Number of observations	37,690						25,287					
Log-likelihood	-12,823						-8,598					

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 marginal effects and elasticities are calculated at the means of the independent variables. 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% (1985) and = 86.4% (1999), where a 0.5 threshold was used. In Regression III (IV) 1936 (1696) observations (that is, 4.9 percent (6.3 percent) of all observations with no missing values) were dropped in order to create a sample that is comparable with the regressions in Table 4 and Table 6.

The Regressions III and IV in Table 5 report results of this estimating equation for 1985 and 1999. The two sample sizes are limited to the sample sizes used in the regressions in Table 4. Thus, the results of the regressions in Table 4 and 5 are directly comparable. The explanatory power of the regressions in Table 5—the percentage of correct tenure predictions—is virtually the same compared to the one of the regressions in Table 4 (86.5 percent for 1985 and 86.4 percent for 1999). With a few exceptions, the coefficients and robust standard errors of the explanatory variables in Table 5 look very similar to the ones in Table 4.

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 has about double size and becomes statistically significant at the 1 percent level in both 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 in many center city neighborhoods.

The second exception concerns the neighborhood externality level variables. With a few exceptions the coefficients have a negative sign and become statistically significant at the 1 percent level.[26] The magnitudes of the effects of the externalities junk and litter, street noise and neighborhood noise on homeownership increase significantly compared to the ones in Table 4. For example, an increase of the externality junk and litter by one standard deviation reduces the probability of homeownership by 4.1 percent for 1985—compared to 1.2 percent in the equivalent regression in Table 4—and by 2.0 percent—compared to 0.1 percent—for 1999. Overall, a comparison of the results in Table 4 and 5 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

The turnover frequency of the unit—measured as the probability of a turnover within a two-year period between 1985 and 1999—was not included as an explanatory variable in the regressions in Table 4 and 5 because the variable is expected to be highly endogenous. This is because

[26] 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.

homeowners typically face far higher relocation costs (including the costs of selling the home) compared to tenants and hence are much less likely to move. However, as discussed in Section 3 the turnover frequency within a unit might cause some neighborhood externality variation even though the true level of neighborhood externalities was stable over time. Therefore, the base regressions in Table 4 were re-estimated including the turnover probability as a control variable. The estimating equation is as follows:

$$\Pr(OWN_i = 1) = f(NER_i, NE_i, Demogr._i, Housing\ Type_i, Location\ Controls_i, Pr(Move)_i), \qquad (4)$$

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 6 reports results for 1985 (Regression V) and 1999 (Regression VI). The sample sizes of the two regressions are the same as in Table 4 and 5. Thus, the results are directly comparable. The percentage of correct homeownership status predictions is slightly higher compared to the ones in the regressions in Table 4 and 5. The two estimates for 1985 and 1999 predict 87.5 percent and 87.8 percent of the housing tenures correctly.

The turnover probability-variable has a negative sign and is strongly statistically significant in both 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. The addition has a relatively minor effect on the statistical and quantitative significance of the risk measures in the specification for 1999 (Regression VI). The quantitative significance of the risk measure for junk and litter even slightly increases. An increase of the risk measure for junk and litter by one standard deviation 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 only statistically significant at the 7 percent level. Furthermore, the risk measure for neighborhood crime is about divided 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, the risk measure for junk and litter—the measure with the largest quantitative effect—remains statistically significant as well as quantitatively meaningful in both regressions for 1985 and 1999.

TABLE 6
Binary Logit Estimate of Homeownership Status Controlling for Turnover Probability in Unit, 1985 and 1999

	Regression V: 1985						**Regression VI: 1999**					
			Marginal Analysis						Marginal Analysis			
Independent Variables	Parameter Estimates	Robust Std. Err.	Marginal Effects	Mean	Std. Dev	Elast.	Parameter Estimates	Robust Std. Err.	Marginal Effects	Mean	Std. Dev.	Elast.
Intercept	1.98**	.070					1.71**	.09				
Std. dev. of junk/litter, 85-99	-.44**	.069	-.088**	.28	.31	-.037**	-.68**	.076	-.13**	.24	.30	-.045**
Std. dev. of street noise, 85-99	-.084	.045	-.017	.56	.47	-.014	-.20**	.051	-.037**	.52	.49	-.029**
Std. dev. of neigh. noise, 85-99	-.23**	.10	-.047**	.13	.21	-.0092**	-.38**	.11	-.070**	.12	.20	-.012**
Std. dev. of neigh. crime, 85-99	-.053	.039	-.011	.54	.54	-.0088	-.14**	.046	-.027**	.51	.54	-.020**
Two or more unit building	-2.84**	.064	-.57**	.29	.45	-.25**	-2.40**	.072	-.44**	.24	.43	-.16**
Unit is a single detached house	.52**	.055	.10**	.63	.48	.098**	.70**	.059	.13**	.64	.48	.12**
Unit is in center city	-.084	.044	-.0168	.36	.48	-.0092	-.11*	.055	-.020*	.31	.46	-.010*
Household income	2.2E-05**	1.1E-06	4.4E-06**	28648	24125	.19**	1.4E-05**	8.2E-07	2.49E-06**	61916	57438	.23**
20 ≤ av. age of adults<25	-1.51**	.080	-.30**	.062	.24	-.029**	-1.25**	.12	-.23**	.049	.22	-.017**
25 ≤ av. age of adults<30	-.92**	.053	-.18**	.12	.33	-.034**	-.68**	.070	-.12**	.10	.30	-.019**
40 ≤ av. age of adults<45	.0030	.067	.001	.089	.29	8.3E-05	.11	.064	.020	.15	.35	.0045
45 ≤ av. age of adults<55	.10	.059	.020	.11	.32	.0035	.18**	.059	.033**	.21	.41	.010**
55 ≤ av. age of adults<65	.33**	.058	.065**	.12	.33	.012**	.54**	.079	.10**	.12	.33	.018**
Family	.064	.057	.013	.72	.45	.014	.29**	.061	.054**	.70	.46	.057**
Married couple	.52**	.049	.10**	.58	.49	.092**	.32**	.053	.059**	.48	.50	.043**
Children	-.67**	.045	-.13**	.37	.48	-.076**	-.20**	.052	-.037**	.34	.48	-.019**
Ethnicity is black	-.48**	.057	-.095**	.10	.31	-.015**	-.45**	.066	-.083**	.11	.31	-.013**
Previous residence outside USA	-1.16**	.19	-.23**	.0079	.089	-.0028**	-.59**	.20	-.11**	.013	.11	-.0021**
Junk/litter in neighborhood	-.069	.038	-.014	.31	.52	-.0065	.045	.053	.0083	.12	.39	.0015
Street noise	-.071**	.022	-.014**	.60	.91	-.013**	-.090**	.028	-.017**	.47	.83	-.012**
Neighborhood noise	-.029	.072	-.0057	.079	.27	-6.9E-04	.057	.13	.011	.029	.17	.00046
Neighborhood crime	.033	.022	.007	.40	.87	.0041	.044	.031	.0081	.28	.73	.0034
Prob. of turnover within 2 y.	-2.95**	.070	-.587**	.23	.29	-.21**	-3.35**	.087	-.62**	.28	.29	-.26**
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 marginal effects and elasticities are calculated at the means of the independent variables. 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% (1985) and = 87.8% (1999), where a .5 threshold was used.

D. Results of Recent Movers Sample Estimates

The regressions in Table 4 to 6 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, and therefore, 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 psychic costs of leaving friends and relatives behind add 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 towards 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 compared to non-recent movers (e.g., Harmon 1988). The above insights are also the standard rationale for the following estimating equation that only includes recent mover units:

$$\Pr(OWN_i = 1 \,|\, MY \leq 2) = f(NER_i, NE_i, Demogr._i, Hous.\ Type_i, Location\ Contr._i, Pr(Move)_i), \quad (5)$$

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 VII) and 1999 (Regression VIII). Because of the exclusion of non-recent movers, the two sample sizes for 1985 and 1999 are about three times smaller compared to the ones in the Tables 4 to 6. Otherwise, the estimating equations are identical to the ones in Table 6. 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 compared to 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 and litter is statistically significant at the 1 percent level in both regressions. The measure for street noise is

only statistically significant at the 8 percent level for 1985 and at 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 of the least visible externality neighborhood crime is not statistically significant in any of the two regressions. This may be because recent movers have much less information about neighborhood crime compared to households that have known the neighborhood for a long time period and therefore are able to reliably evaluate the level of neighborhood crime.

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 compared to the estimates that are based on the full sample of housing units.[27] Specifically, an increase of the (statistically significant) risk measure for junk and litter by one standard deviation reduces the probability of owning by 8.1 percent for 1985 and by 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.

At a 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, only looking at recent movers leads to a large reduction of the sample size and is a waste of information. Second, the recent mover hypothesis only holds 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 that the equations estimated for recent movers 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. Using data for Sweden, 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.

[27] 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.

TABLE 7

Binary Logit Estimate of Homeownership Status for Recent Movers Controlling for Turnover Probability, 1985 and 1999

	Regression VII: 1985						**Regression VIII: 1999**					
			Marginal Analysis						Marginal Analysis			
Independent Variables	Parameter Estimates	Robust Std. Err.	Marginal Effects	Mean	Std. Dev	Elast.	Parameter Estimates	Robust Std. Err.	Marginal Effects	Mean	Std. Dev.	Elast.
Intercept	.95**	.11					.82**	.14				
Std. dev. of junk/litter, 85-99	-.57**	.11	-.10**	.31	.30	-.082**	-.81**	.12	-.15**	.28	.30	-.11**
Std. dev. of street noise, 85-99	-.13	.072	-.022	.63	.49	-.038	-.18*	.079	-.034*	.60	.51	-.056*
Std. dev. of neigh. noise, 85-99	-.15	.17	-.026	.16	.22	-.011	-.61**	.18	-.11**	.15	.22	-.045**
Std. dev. of neigh. crime, 85-99	-.022	.062	-.0038	.62	.57	-.0066	-.095	.069	-.018	.59	.57	-.028
Two or more unit building	-2.69**	.10	-.46**	.48	.50	-.61**	-2.19**	.11	-.41**	.44	.50	-.48**
Unit is a single detached house	-.011	.081	-.0018	.42	.49	-.0021	.69**	.085	.13**	.42	.49	.15**
Unit is in center city	-.14	.072	-.024	.40	.49	-.026	-.18*	.082	-.033*	.39	.49	-.035*
Household income	2.9E-05**	1.6E-06	4.9E-06**	27241	22826	.37**	1.1E-05**	1.2E-06	2.0E-06**	49919	48068	.27**
20 ≤ av. age of adults<25	-.49**	.089	-.082**	.17	.38	-.039**	-.89**	.12	-.17**	.14	.34	-.061**
25 ≤ av. age of adults<30	-.18**	.070	-.030**	.25	.43	-.021**	-.40**	.088	-.074**	.21	.41	-.042**
40 ≤ av. age of adults<45	-.17	.12	-.028	.063	.24	-.0049	.014	.11	.0026	.11	.31	.00079
45 ≤ av. age of adults<55	.093	.11	.016	.071	.26	.0031	.067	.11	.012	.13	.33	.0042
55 ≤ av. age of adults<65	.14	.13	.023	.052	.22	.0034	.80**	.16	.15**	.05	.21	.019**
Family	-.020	.10	-.0034	.67	.47	-.0063	.17	.10	.031	.56	.50	.047
Married couple	.56**	.081	.094**	.51	.50	.13**	.42**	.087	.077**	.39	.49	.082**
Children	-.39**	.070	-.066**	.43	.50	-.080**	-.17*	.081	-.031*	.33	.47	-.028*
Ethnicity is black	-.51**	.11	-.086**	.11	.31	-.025**	-.47**	.11	-.087**	.12	.32	-.028**
Prev. residence outside USA	-.65*	.27	-.11*	.014	.12	-.0044*	-.64**	.25	-.12**	.027	.16	-.0088**
Junk/litter in neighborhood	-.094	.064	-.016	.33	.54	-.015	.14	.090	.027	.14	.43	.010
Street noise	-.032	.036	-.0054	.65	.96	-.010	-.17**	.049	-.032**	.50	.84	-.043**
Neighborhood noise	-.12	.12	-.021	.098	.30	-.0057	.22	.21	.042	.034	.18	.0038
Neighborhood crime	.046	.038	.0078	.42	.91	.0092	.0081	.052	.0015	.30	.75	.0012
Prob. of turnover within 2 y.	-3.02**	.12	-.51**	.40	.33	-.57**	-2.23**	.13	-.41**	.54	.29	-.61**
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 2 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 marginal effects and elasticities are calculated at the means of the independent variables. 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 not used. Percent of correct predictions = 84.7% (1985) and = 83.1% (1999), where a .5 threshold was used.

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 towards 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 6 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—either measured as the percentage of correct predictions or measured as pseudo R^2 –is significantly lower in the recent mover estimates compared to the full sample estimates.[28] This suggests that the logit-regressions that are based on the full sample may better estimate the true magnitude of the effects of the neighborhood externality risk measures on homeownership.

E. Discussion of Potential Endogeneity and Causality

The previous results (Tables 4 to 7) suggest that several neighborhood externality risk measures are related to the probability that a housing unit is owner-occupied. The estimated 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 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.[29] Either homeowner-associations or dominant landlords may affect the neighborhood quality and possibly the variation of neighborhood externalities.

Several studies suggest that the homeownership status affects the behavior of its occupants. For example, Rossi and Weber (1996) and DiPasquale and Glaeser (1999) suggest that homeownership encourages investment in local amenities and social capital. Green and White

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[28] 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 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.

[29] 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.

(1997) provide evidence that homeownership provides a better environment for the upbringing of children. Galster (1983) suggests that due to moral hazard problems tenants treat their units less carefully than homeowners. 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 whether the homeownership status may also affect the variation—rather than the level—of neighborhood externalities.

Essentially, there are only a few institutional settings that 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 are typically 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.[30] Thus, the neighborhood externality variation is expected to be endogenous in newly developing neighborhoods—were 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 only include 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 sample this fraction is 7.6 percent, in the recent mover sample this fraction is 17.2 percent. The logit models for 1985 were re-estimated using samples that only include housing units that were built prior to 1980 and even prior to 1970. The coefficients and statistical significance levels are virtually not affected by the exclusion of the 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 not affected by the exclusion

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

of the newly constructed units. Evidently, these results are only conjecturing and cannot fully address the concern of endogeneity.

The potential problem of endogeneity or reversed causality could be best 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 analyses 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.

While it is plausible that homeowner-associations or landlords may affect the neighborhood externality variation. 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 at time period of 5 years housing tenure transitions are indeed fairly isolated cases and concerted actions with respect to housing tenure changes in the same direction are very seldom.[31] Consequently, it is highly unlikely that housing tenure transitions over a period of 5 years explain future variation of neighborhood externalities.

[31] The sub-sample for 1985 consists of units in 665 neighborhoods or "clusters". The average number of units within a cluster is 10.3 housing units. 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" are indeed very seldom. Only in 4.7 percent of all clusters the probability that a random neighbor also becomes a renter-occupier is greater than .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 is greater than .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.

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 disequilibria situation with corresponding adjustments. That is, the owner is expected to adjust the optimal homeownership status to the 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 to become 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.

The Tables 8 and 9 report binary logit estimates of homeownership status changes between 1985 and 1989. To begin with, Table 8 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 estimating equation. The first specification of the estimating equation is as follows:

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

where $\Pr(OWN_i^{85} \rightarrow RENT_i^{89} \,|\, OWN_i^{85})$ is the probability that the ith 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 estimating equation (2).

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

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

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.

The Regressions IX and X in Table 8 report logit estimates corresponding to the estimating equations (6.1) and (6.2). Due to the addition of variables for 1989 the sample size (of 4,796 observations in both regressions) is considerably smaller compared to 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 found to be significantly different from zero. Thus, rather than just comparing the statistical significance levels of the variables, increased attention is drawn on the quantitative significance of the effects. Indeed, fewer variables are statistically significant at the 5 or 1 percent level. However, the quantitative effects of these statistically significant variables are very meaningful in most cases. Furthermore, the estimates predict a very high percentage of the homeownership status changes correctly. The percentage of correct predictions is 90.0 percent for Regression IX and 90.9 percent for Regression X.

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 and litter is statistically significant at the 1 percent level in Regression IX and at the 5 percent level in Regression X. The marginal analysis suggests that the risk measure for junk and litter is also quantitatively meaningful. An increase of 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 in Regression IX and by 6.5 percent according to the estimates in Regression X.

TABLE 8
Binary Logit Estimates of Homeownership Status Changes from Owner-occupied to Renter-Occupied between 1985 and 1989

	$Pr(Own_{85} \rightarrow Rent_{89} \mid Own_{85})$							
	Regression IX: Excluding Pr(Turnover)			**Regression X: Including Pr(Turnover)**			Descript. Stat.	
Independent Variables	Coeff.	R. Std. Err.	Marg. Eff.	Coeff.	R. Std. Err.	Marg. Eff.	Mean	Std. Dev
Intercept	-2.63**	.23		-4.05**	.28			
Std. dev. of junk/litter, 89-99	.63**	.16	.038	.47*	.19	.021	.23	.31
Std. dev. of street noise, 89-99	.18	.12	.011	.063	.13	.0028	.48	.47
Std. dev. of neigh. noise, 89-99	.26	.29	.016	.39	.32	.018	.095	.19
Std. dev. of neigh. crime, 89-99	.072	.11	.0044	.068	.12	.0030	.46	.51
Two or more unit building	1.30**	.24	.079	1.47**	.27	.066	.099	.30
Unit is a single detached house	.21	.19	.013	.48*	.22	.022	.80	.40
Unit is in center city	.079	.13	.0048	.088	.15	.0040	.28	.45
Household income, 85	3.6E-06	2.7E-06	2.2E-07	4.3E-06	2.8E-06	1.9E-07	31957	25492
Household income, 89	-1.2E-05**	3.1E-06	-7.3E-07	-1.3E-05**	3.2E-06	-6.0E-07	36988	29618
20 ≤ av. age of adults<25, 85	.28	.31	.017	.36	.33	.016	.018	.13
20 ≤ av. age of adults<25, 89	1.82**	.21	.11	1.51**	.22	.068	.033	.18
25 ≤ av. age of adults<30, 85	.35*	.17	.021	.29	.19	.013	.092	.29
25 ≤ av. age of adults<30, 89	1.01**	.16	.061	.80**	.18	.036	.087	.28
40 ≤ av. age of adults<45, 85	-.083	.21	-.0050	-.0052	.22	-.00023	.098	.30
40 ≤ av. age of adults<45, 89	.15	.19	.0088	.22	.20	.0098	.10	.30
45 ≤ av. age of adults<55, 85	.16	.19	.010	.29	.21	.013	.12	.33
45 ≤ av. age of adults<55, 89	-.17	.22	-.010	-.13	.22	-.0059	.13	.34
55 ≤ av. age of adults<65, 85	-.46*	.21	-.028	-.32	.23	-.015	.14	.35
55 ≤ av. age of adults<65, 89	-.59*	.27	-.036	-.43	.29	-.019	.12	.33
Family, 85	-.74**	.23	-.045	-.74**	.25	-.033	.79	.41
Family, 89	-.22	.21	-.014	-.0051	.23	-.00023	.77	.42
Married couple, 85	.43*	.20	.026	.51*	.22	.023	.68	.47
Married couple, 89	-.50**	.17	-.030	-.48**	.18	-.021	.64	.48
Children, 85	-.20	.16	-.012	-.16	.16	-.0073	.38	.48
Children, 89	1.18**	.17	.072	1.19**	.17	.053	.38	.49
Ethnicity is black, 85	-.62	.39	-.038	-.35	.43	-.016	.087	.28
Ethnicity is black, 89	-.039	.36	-.0024	.013	.38	.00060	.10	.30
Prev. residence outside USA, 85	1.35*	.58	.082	1.09*	.53	.049	.0046	.068
Prev. residence outside USA, 89	1.63**	.53	.099	1.30*	.51	.058	.0038	.061
Change junk/litter, 89-99	-.15	.084	-.0092	-.23*	.093	-.010	-.12	.56
Change street noise, 89-99	.012	.052	.00071	.024	.057	.0011	-.092	1.00
Change nghd noise, 89-99	.069	.18	.0042	.0016	.20	.000073	-.037	.28
Change nghd crime, 89-99	.11*	.054	.0068	.14*	.059	.0061	-.16	.97
Probability of turnover within 2 years				4.13**	.23	.19	.15	.22
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 marginal effects and elasticities are calculated at the means of the independent variables. 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% (Regression IX) and = 90.9% (regression X), where a .5 threshold was used. In Regression IX 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 X.

The quantitative size of the effect is quite meaningful even compared to some of the traditional explanatory variables.[32]

Besides the neighborhood externality risk measure for junk and litter, several traditional explanatory variables also explain ownership status changes from owner-occupied to renter-occupied. That is, several demographic characteristics of previous and of 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 precedent homeownership status change from owner-occupied to renter-occupied. The effect is highly statistically significant as well as quantitatively meaningful. The inclusion of the turnover-probability reduces the coefficient on the risk measure for junk and litter by about one quarter.

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:

$$\Pr(RENT_i^{85} \rightarrow OWN_i^{89} \,|\, RENT_i^{85}) = f(NER_i^{89\text{-}99}, \Delta NE_i^{89\text{-}99}, X_i^{85}, X_i^{89}) \qquad (7.1)$$

$$\Pr(RENT_i^{85} \rightarrow OWN_i^{89} \,|\, RENT_i^{85}) = f(NER_i^{89\text{-}99}, \Delta NE_i^{89\text{-}99}, X_i^{85}, X_i^{89}, Pr(Move)_i^{89\text{-}99}), \qquad (7.2)$$

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.

The Regressions XI and XII in Table 9 report the binary logit estimates corresponding to the estimating equations (7.1) and (7.2). The estimates are based on a sample of 4,045 observations and predict 91.7 percent (Regression XI) and 92.5 percent (Regression XII) correctly.

Consistent with Prediction 1, the coefficients of the four neighborhood externality risk measures all 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.

[32] See Table A2 in the Appendix for a comparison of quantitative effects of all explanatory variables.

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

	$Pr(Rent_{85} \rightarrow Own_{89} \mid Rent_{85})$						Descript. Stat.	
	Regression XI: Excluding Pr(Turnover)			**Regression XII: Including Pr(Turnover)**				
Independent Variables	Coeff.	R. Std. Err.	Marg. Eff.	Coeff.	R. Std. Err.	Marg. Eff.	Mean	Std. Dev
Intercept	-2.41**	.30		-1.64**	.30			
Std. dev. of junk/litter, 89-99	-.38	.24	-.015	-.32	.25	-.010	.36	.30
Std. dev. of street noise, 89-99	-.68**	.16	-.027	-.53**	.17	-.017	.70	.47
Std. dev. of neigh. noise, 89-99	-.051	.33	-.0020	-.014	.34	-.00044	.17	.23
Std. dev. of neigh. crime, 89-99	-.13	.14	-.0053	-.16	.15	-.0049	.70	.56
Two or more unit building	-1.42**	.23	-.056	-1.30**	.24	-.041	.73	.44
Unit is a single detached house	.69**	.23	.027	.53*	.24	.017	.20	.40
Unit is in center city	-.020	.15	-.00079	-.0061	.16	-.00019	.48	.50
Household income, 85	4.8E-06	3.4E-06	1.9E-07	6.6E-06*	3.3E-06	2.1E-07	20012	17479
Household income, 89	2.0E-05**	2.9E-06	8.0E-07	2.2E-05**	3.2E-06	7.0E-07	23739	20111
20 ≤ av. age of adults<25, 85	-.28	.23	-.011	-.19	.24	-.0061	.15	.36
20 ≤ av. age of adults<25, 89	-.24	.24	-.0095	.086	.24	.0027	.13	.34
25 ≤ av. age of adults<30, 85	.040	.16	.0016	.15	.17	.0046	.20	.40
25 ≤ av. age of adults<30, 89	-.29	.18	-.012	-.072	.19	-.0023	.20	.40
40 ≤ av. age of adults<45, 85	.039	.26	.0015	-.13	.27	-.0041	.061	.24
40 ≤ av. age of adults<45, 89	.10	.24	.0040	.18	.25	.0057	.072	.26
45 ≤ av. age of adults<55, 85	-.088	.27	-.0035	-.14	.28	-.0044	.068	.25
45 ≤ av. age of adults<55, 89	.040	.25	.0016	.012	.25	.00039	.078	.27
55 ≤ av. age of adults<65, 85	-.19	.30	-.0074	-.19	.30	-.0060	.067	.25
55 ≤ av. age of adults<65, 89	.71**	.27	.028	.51	.29	.016	.060	.24
Family, 85	.58*	.23	.023	.39	.24	.012	.59	.49
Family, 89	-.022	.23	-.00088	-.040	.25	-.0013	.58	.49
Married couple, 85	-.34	.18	-.014	-.28	.19	-.0088	.39	.49
Married couple, 89	.59**	.18	.023	.49**	.19	.015	.35	.48
Children, 85	-.13	.18	-.0051	-.0072	.18	-.00023	.37	.48
Children, 89	-.0084	.17	-.00033	-.0015	.18	-.000046	.39	.49
Ethnicity is black, 85	.43	.29	.017	.52	.33	.016	.15	.35
Ethnicity is black, 89	-.82**	.30	-.033	-.99**	.34	-.031	.16	.37
Prev. residence outside USA, 85	-.59	.52	-.023	-.60	.53	-.019	.018	.13
Prev. residence outside USA, 89	-.51	.73	-.020	-.083	.79	-.0026	.012	.11
Change junk/litter, 89-99	-.12	.11	-.0047	-.062	.11	-.0020	-.18	.67
Change street noise, 89-99	-.075	.065	-.0030	-.10	.066	-.0032	-.14	1.21
Change nghd noise, 89-99	-.045	.21	-.0018	-.054	.22	-.0017	-.087	.38
Change nghd crime, 89-99	.040	.061	.0016	.047	.061	.0015	-.23	1.26
Probability of turnover within 2 years				-2.80**	.29	-.088	.46	.29
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 marginal effects and elasticities are calculated at the means of the independent variables. 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% (regression XI) and = 92.5% (regression XII), where a .5 threshold was used.

An increase of 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.

Besides the neighborhood externality risk measure for street noise, only relatively few traditional explanatory variables have a statistically significant effect on homeownership status changes from renter-occupied to owner-occupied. The control variable "turnover probability" is negatively related to the probability of a homeownership status change from renter-occupied to owner-occupied. The effect is statistically significant as well as quantitatively meaningful. The inclusion of the turnover probability variable reduces the coefficient on the risk measure for street noise by roughly 20 percent.

While all neighborhood externality risk measures have the expected sign in all of the regressions in the Tables 8 and 9, 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. Although the results are certainly not entirely conclusive, overall, the results of the causality test seem to suggest that the effects of certain neighborhood externality risk measures on homeownership are causal. Finally, the analysis of homeownership status changes also confirms that the housing type and several life cycle attributes are major determinants of ownership status changes of residential properties.

5 Conclusions

In this paper it is argued that owner-occupied housing typically causes a portfolio distortion for single owner-occupiers. This distortion increases with housing 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 compared to renter-occupied housing. Ceteris paribus, neighborhood specific differences in externality risk should affect the neighborhood specific probability of homeownership. The presented empirical evidence strongly supports this proposition and suggests that the relationship may be causal.

The reported neighborhood externality risk measures are typically higher in center city places and in distressed neighborhoods. This empirical fact has several important implications. First, the presented logit models suggest that the neighborhood externality risk measures explain about half of the so far 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 and relative landlord production efficiency differences 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 moral hazard problems of tenants—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". The main political goal of this program has been to avoid "panic peddling" and thereby to avoid the further outflow of responsible residents. However, neither the Chicago "home equity assurance program" nor other attempts by local governments in the Chicago area have been particularly successful in dealing with the moral hazard and the selection bias problem. Furthermore, the programs have administrative shortfalls that may provide fertile ground for disputes, and ultimately lawsuits. Shiller and Weiss (1999) propose modifications involving a real estate price index that might deal better with the problem of moral hazard. These modifications may also be suitable for a number of other home equity conversion forms such as reverse mortgages, shared-appreciation mortgages, housing partnerships, shared-equity mortgages and sale of reminder interest (Shiller and Weiss 2000). However, until now none of the modifications proposed by Shiller and Weiss (1999 and 2000) have been implemented. The findings in the empirical section of this paper suggest that the most crucial modification proposed by Shiller and Weiss (1999)—the real estate price index—ought to be neighborhood specific in order to be implemented successfully.

Finally, there are a number of possible directions for future research. Given the fact that homeownership and the avoidance of neighborhood decay are considered as politically most desirable goals one could further focus on institutional settings that may avoid neighborhood externality risk initially. Such institutional settings are deed restrictions and neighborhood

covenants in newly developing neighborhoods. These settings may give additional incentives to own rather than rent and thus help avoid the potential future decay of neighborhoods. In case of the existence of neighborhood externality risk in established neighborhoods, one could focus on mechanisms that insure against the risk subsequently. In particular, a more thorough political economic analysis of previous attempts to implement home equity insurance programs—and other forms of home equity conversion—might help to avoid failures in the future. One might also further examine how private insurance companies could successfully implement home equity insurance models against neighborhood externality risk, in particular, how they might overcome the problem of creating reliable house price indexes on the neighborhood level.

At last, the methodology used in this paper can be used for other related research questions. For example, the Chicago experience shows that the "home equity assurance program" has been most popular in predominantly white areas that face uncertain future ethnicity mixes. One might therefore expect that the neighborhood specific uncertainty about the future ethnicity mix is another significant determinant of the ownership status of residential properties. Measures of ethnic uncertainty can be evaluated on the neighborhood-level and these measures can then be used to examine the influence of ethnic uncertainty on the homeownership status of properties. Obviously, such a study will have to take into account the literature on discrimination in residential-mortgage lending (e.g., Munell *et al.* 1996 and Ladd 1998) and, in particular, the issue of "geographic redlining", that is, the behavior of lenders to deny loans to an area because it has a large proportion of minority residents or because it is poor and rundown.[33]

A last possible expansion of the research directs to this mortgage lending decision and potential discrimination against minorities in mortgage lending. Neighborhood specific risks are expected to affect the rate of return on the loan. However, mortgage lenders may not be able to fully price high neighborhood specific risks into mortgage interest rates. Hence, they may have incentives to avoid locations with high neighborhood specific risks. Most studies of discrimination in mortgage lending and redlining provide little or no evidence that mortgage lenders are currently discriminating against certain allegedly redlined areas. The vast majority of studies suggests that lenders discriminate not on the basis of the location of the property but rather on the basis of the race of the applicant (Ladd 1998). However, previous studies only use rough proxies for

[33] 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.

neighborhood specific risks. In contrast, the neighborhood externality risk measures used in this paper–and a measure for ethnic uncertainty, which will be developed and tested in future research—are direct measures of neighborhood specific risks. Future work will therefore address whether mortgage originators take into account these neighborhood specific real estate risks 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. Financial institutions that take into account neighborhood specific risks in their lending decisions might provide an alternative theoretical explanation for why neighborhoods with high neighborhood specific risks have lower homeownership rates. However, even if it turned out that neighborhood externality risk measures affect the lending decision and thereby the homeownership status, the fact remains that neighborhood externality risk is an important and so far overlooked determinant of the homeownership status of properties, and the main conclusions of this paper still remain valid.

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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	.6535	.4758	0	1
Homeownership dummy, 1999	25287	.6669	.4713	0	1
Housing Structure Type, Overall Unit- and Neighborhood Quality, Probability of Turnover Within Unit					
One unit detached house dummy, 1985	37690	.6254	.4840	0	1
One unit detached house dummy, 1999	25287	.6410	.4797	0	1
Two or more unit building dummy, 1985	37690	.2866	.4522	0	1
Two or more unit building dummy, 1999	25287	.2438	.4294	0	1
Overall housing unit quality, 1985 †	37541	8.241	1.915	1	10
Overall housing unit quality, 1999 †	25115	8.002	1.688	1	10
Overall neighborhood quality, 1985 †	37459	8.102	2.149	1	10
Overall neighborhood quality, 1999 †	25016	7.878	1.826	1	10
Prob. of turnover within 2 y. (85-99), 85	37690	.2327	.2894	0	1
Prob. of turnover within 2 y. (85-99), 99 †	25287	.2841	.2925	0	1
Household Specific Information					
Household income, 1985	37690	28648.3	24124.6	0	264600
Household income, 1999	25287	61916.3	57438.4	0	774424
Ethnicity of household head is black, 1985	37690	.1045	.3060	0	1
Ethnicity of household head is black, 1999	25287	.1072	.3094	0	1
Family lives in unit, 1985	37690	.7237	.4472	0	1
Family lives in unit, 1999	25287	.7036	.4567	0	1
Married couple lives in unit, 1985	37690	.5829	.4931	0	1
Married couple lives in unit, 1999	25287	.4781	.4995	0	1
One or more children live in unit, 1985	37690	.3718	.4833	0	1
One or more children live in unit, 1999	25287	.3442	.4751	0	1
Previous residence outside USA, 1985	37690	.007907	.08857	0	1
Previous residence outside USA, 1999	25287	.01269	.1120	0	1
Average age of adults in unit, 1985	37690	45.62	17.27	18	91
Average age of adults in unit, 1999	25287	41.97	12.14	18	93
General Location Specific Variables					
Center city dummy, 1985	37690	.3591	.4798	0	1
Center city dummy, 1999	25287	.3149	.4645	0	1
Unit is inside MSA, 1985	37690	.7998	.4001	0	1
Unit is inside MSA, 1999	25287	.8148	.3885	0	1
General Recent Mover Information ††					
Homeownership dummy, 85, recent movers	12027	.3574	.4793	0	1
Homeownership dummy, 99, recent movers	8230	.3672	.4821	0	1
Av. age of adults in unit, 1985, recent movers	12027	35.18	13.29	18	91
Av. age of adults in unit, 1999, recent movers	8230	35.21	10.71	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 and 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 and litter in neighborhood, 85	37690	0.3059	0.5238	17899	0.2771	0.5009	0	2
Junk and litter in neighborhood, 87	19304	0.3233	0.5316	12052	0.2858	0.5072	0	2
Junk and litter in neighborhood, 89	18915	0.3213	0.5340	9613	0.2780	0.5048	0	2
Junk and litter in neighborhood, 91	16474	0.2952	0.5091	10656	0.2570	0.4804	0	2
Junk and litter in neighborhood, 93	19514	0.3034	0.5214	11896	0.2419	0.4785	0	2
Junk and litter in neighborhood, 95	16547	0.2939	0.5161	15233	0.2295	0.4678	0	2
Junk and litter in neighborhood, 97	28235	0.1348	0.4215	20930	0.1200	0.3984	0	2
Junk and 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 and 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 and 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 and 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 USA, 1985	4796	0.00459	0.0676	4045	0.0178	0.1322	0	1
Prev. residence outside USA, 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 4: Basic		Table 5: No Risk		Table 6: Incl. Pr(Move)		Table 7: Recent Movers		Table 8: Pr(Own->Rent)		Table 9: Pr(Rent->Own)	
Independent Variables	I (85)	II (99)	III (85)	IV (99)	V (85)	VI (99)	VII (85)	VIII (99)	IX (ePT)	X (iPT)	XI (ePT)	XII (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 USA, 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 USA, 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 2 years".