An Economic Analysis of Housing Abandonment

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Abstract

Landlord abandonment of rental housing has affected many American cities since the 1960's. Because of data limitations, there have been few empirical analyses of the determinants of housing abandonment. In this paper, we use a rich database that contains information on individual residential properties in New York City to estimate a reduced form model of owner abandonment. We model an owner's decision to abandon his or her property as being similar to an investor's decision to exercise a put option on a financial instrument. When required to pay delinquent taxes, a wealth maximizing landlord has an incentive to cede ownership of its residential property when the value of all outstanding liens exceeds the property's market value. Estimates from the model are used to examine whether empirical evidence supports this option model of abandonment.

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I. Introduction

Disinvestment in residential real estate plagues many large American cities. In 1996, approximately 23,000 dwelling units in New York City had reached the end of the disinvestment process--abandonment by the owner. Similar, albeit less intense, incidences of abandoned housing affect many large cities such as Atlanta, Chicago, Detroit and Philadelphia. Landlord abandonment of rental housing is not a new phenomenon. Many American cities experienced a wave of property tax delinquencies and landlord abandonment of rental housing in the late 1960's and 1970's. Of 149 cities surveyed by the U.S. General Accounting Office (GAO) in 1979, 113 reported that they had some level of abandonment problems and 26 reported that they had "major" or "substantial" abandonment problems (U.S. GAO, 1979). On average, the rate of abandonment for 58 cities in the Northeast was 1.3% of all residential units in 1975 (James,

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1980). Landlords who abandon their properties typically stop paying operating costs, debt service, and real property (ad valorem) taxes. Eventually, local governments may take over these properties as a result of tax foreclosure actions.

A landlord's decision to abandon his or her building may have many negative effects both for residents of the building and the surrounding neighborhood. In many instances, landlord disinvestment results in property deterioration. Indeed, in 1996, according to the New York City Housing and Vacancy Survey, conducted by the Census Bureau, the incidence of serious dilapidation in properties taken over by the City as a result of tax foreclosure was more than ten times the city-wide average (Schill and Scafidi forthcoming 1999).[1] Abandoned housing may also have negative consequences that reach beyond an individual building and its tenants. Deteriorated housing may generate negative externalities for the communities in which it is located. For example, abandoned buildings can become eyesores deterring investment nearby; they can also become magnets for crime and fire hazards. The decision by an owner to abandon his or her property also deprives the City of tax revenue and, if the building deteriorates too far, reduces the stock of housing in absolute terms.

Because of data limitations, there has been very little empirical analysis of the determinants of housing abandonment. In this paper, we model a landlord's decision to abandon his or her property as being similar to an investor's decision to exercise a put option on a financial

[1]According to the Housing and Vacancy Survey, 14.9% of all residential properties owned by the City of New York are dilapidated as compared to 1.1% of all rental units in the City. In addition, 19.8% of the City-owned stock has five or more maintenance deficiencies compared to 4.5% for all rental dwellings in New York (Schill and Scafidi forthcoming 1998).

instrument.[2] When required to pay delinquent taxes, a wealth maximizing landlord has an incentive to abandon its residential property when the value of all outstanding liens exceeds the property's market value.[3] To estimate this model of abandonment we use a rich database that contains information on all residential properties in New York City. Estimates from the model allow us to make inferences about whether empirical evidence supports the option theory of abandonment.

Section II provides a survey of the empirical literature on housing abandonment. In Section III we describe the option theory of landlord abandonment. The data used in this study are described in Section IV. The econometric model and results are presented in Section V and Section VI provides concluding remarks.

II. Previous Empirical Literature on Housing Abandonment

Because of data limitations, there has been very little empirical analysis of housing abandonment. Most studies use aggregate data to investigate the relationship between local tax policies and abandonment. For example, Green and White (1997) use data from the 1989 and 1993 American Housing Surveys (AHS) to investigate the extent to which the presence of abandoned buildings in a neighborhood affects the likelihood of further abandonment and whether

[2] The model is analogous to mortgage default models in the housing finance literature where mortgage default has been modeled as a put option. In Section III, we briefly discuss this literature.

[3] For expositional purposes, we use a local government as the example of a lienor collecting property taxes. However, the same abandonment incentives exist in the case of liens held by other levels of government, a mortgage lender, or any other lienor requiring the payment of delinquent balances. Owners have an incentive to abandon their residential properties when the value of outstanding liens on their properties exceeds the market value and cash flow is negative, regardless of whether a local government requires immediate payment of back property taxes or a mortgage lender requires the payment of delinquent mortgage payments.

higher property taxes are associated with higher levels of abandonment. Residents were asked whether their neighborhoods had no abandoned buildings, one abandoned building, or more than one abandoned building. They find that dwellings in neighborhoods with one abandoned dwelling in 1989 were more likely to experience an increase in abandoned buildings in 1993 than dwellings in neighborhoods with no abandoned dwellings in 1989.[4] Green and White also find no evidence that higher tax rates or tax levels are correlated with higher levels or increases in abandonment.

These findings conflict with the results of two earlier studies, one by White (1986) and the other by Arsen (1992). Using aggregate neighborhood level data from New York City in the 1970's, White labels properties that were in tax arrears for eighteen months to three years as abandoned. She finds that the mean ratio of property tax payments to rent revenues in a neighborhood has a positive and significant effect on the neighborhood's rate of abandonment, and that the elasticity of abandonment with respect to property tax payments, holding rent revenues constant, is between 1.65 and 2.10.[5]

Arsen (1992) suggests that many of the buildings that White (1986) classifies as abandoned would never actually have been abandoned because the landlords would eventually pay their delinquent property taxes. Therefore, Arsen characterizes a building as abandoned only if the building was in the process of foreclosure proceedings brought the City of New York. Like White, Arsen uses aggregate neighborhood data from the 1970's for New York City to estimate his model. He finds that the ratio of assessed value to market value, the "assessment rate," had a

[4] Green and White estimated an ordered probit model with a trichotomous dependent variable: a decrease in abandonment, the same level of abandonment, and an increase in abandonment. Because of right censoring of the number of neighborhood abandonments in the AHS data, they had to drop from their sample all observations that reported that there was more than one abandoned property in their neighborhood in 1989.

[5] White estimated separate elasticities for 1976 and 1978 data.

positive and statistically significant effect on the likelihood of abandonment with elasticities of abandonment with respect to assessment rates ranging from 2.0 to 3.7. Although he estimates a different empirical model than White with different data, the main implication of Arsen's results is the same as White's: high property taxes are an important cause of residential abandonment.

The definition of "abandonment" employed by Arsen (1992) as well as the definitions used by White (1986) and Green and White (1997) focus on the processes of owner disinvestment and nonpayment of taxes that do not necessarily culminate in the owner's losing title to its property (O'Flaherty 1990). In most jurisdictions, an owner of tax delinquent property may retain title provided that it redeems the property prior to tax foreclosure.[6]

The difference between White (1986) and Arsen (1992) with respect to the appropriate definition of abandonment illustrates one of the central difficulties of studying the process--the difficulty of obtaining an objective indicator of abandonment. Bender (1979) utilizes a definition of abandonment in his Chicago study that focuses on title forfeiture. A building is classified as abandoned if the private owner ceded title to the City of Chicago and the building was subsequently demolished by the City. Bender hypothesizes that abandonment is caused by weak location-specific housing demand and uses the average neighborhood price per square foot of land and neighborhood median income as his measures of housing demand. His dependent variable is the fraction of buildings in a neighborhood that had been demolished by the City between 1966 and 1971.[7] Bender finds that the average price per square foot of land and the neighborhood

[6]Indeed, according to the Community Service Society (1993), in New York City approximately 90% of all landlords with two or more years of tax arrears in the 1980s eventually paid their delinquent tax bills.

[7] A neighborhood was defined as a collection of Census tracts. The city of Chicago is divided into 84 neighborhoods, although Bender restricted his analysis to the 41 neighborhoods containing 95% of all demolitions that occurred in Chicago during the relevant time period..

median income level are negatively related to neighborhood abandonment rates and statistically significant.[8] He also finds that the neighborhood's median building age is positively related to demolitions and statistically significant. The mean assessment ratio, computed by dividing assessed value by market value, is not found to be a significant predictor of city demolition, and changed sign across model specifications. Bender attributes this result to the likelihood that the assessment ratios were capitalized in land prices. If this is true, then any positive effect of assessment ratios on demolition rates would be captured by the coefficient on the price of land.

III. The Option Model of Landlord Abandonment

We model a landlord's abandonment decision as similar to the decision by an investor to exercise a "put" option on a financial instrument. Option theory has been used in the housing finance literature primarily to model a borrower's decision whether to default on a mortgage. We use the insights from this literature to construct a model of landlord abandonment of residential property. Subsection A describes the option theory of mortgage default, and Subsection B adapts this theory to the problem of landlord abandonment. In Section V, this option model of abandonment is estimated using heretofore unavailable property-level data provided by the City of New York.

[8] Bender also investigated the determinants of private building demolition rates across neighborhoods and found that neighborhood average prices of land and neighborhood median incomes were negatively related to private demolitions and statistically significant. He also found that median building age was positively related to private demolitions and statistically significant. Bender distinguishes between private and public demolitions because both involve negative externalities in their neighborhoods, but public demolitions involve fiscal burdens as well.

A. The Option Theory of Mortgage Default

In the housing finance literature, the mortgage default decision is modeled as a choice over whether to exercise a put option (Quercia and Stegman, 1992). Many financial instruments such as bonds contain explicit put option provisions. A mortgage loan provides a borrower with an implicit put option. If the value of the borrower's property falls below the strike price (i.e the present value of the mortgage), then it is in the financial interest of the borrower to exercise the put option and exchange his or her property for the strike price. Borrowers who exercise their put options, exchanging their properties in return for a predetermined strike price, whenever it maximizes their wealth are said to exercise their put options "ruthlessly".[9] When a borrower defaults on a mortgage loan, he or she allows the lender to take title to the property in return for not having to pay back the balance of the loan:[10] Thus the outstanding balance on the loan is analogous to a predetermined strike price, and the borrower's property is analogous to a bond.[11] If the exercise of a put option is wealth maximizing, then the option is termed "in the money." A crude measure of whether exercising a mortgage default option would be wealth maximizing is the ratio of the mortgage to the market value of the property (i.e. the-loan-to value ratio). If mortgage default were ruthless, then the mortgage put option would be exercised whenever the

[9] Many bonds contain explicit put option provisions in order to put an upper bound on the risk assumed by the bond purchaser. The holder of a bond with a put option knows that the worst possible outcome is that he or she will sell the bond in exchange for the predetermined strike price. Evidence that put options on bonds are generally exercised ruthlessly is found in Quigley and Van Order (1992).

[10] The option theory of mortgage default implicitly assumes that upon default, the lender will not be able to reach the assets of the borrower other than the property securing the loan.

[11] Prepaying a mortgage could be modeled as a call option, but that scenario is not relevant to this study of the determinants of abandonment.

loan-to-value ratio was greater than one.[12] There is widespread evidence in the mortgage default literature that contemporaneous loan- to- value ratios are positively correlated with mortgage default.[13]

B. The Option Theory of Abandonment

The focus of this paper is on the decision facing an owner of real property when a City requires him or her to pay delinquent taxes or suffer loss of title to the property. An owner who allows title to its property to be taken by a municipality when faced with this situation is said to abandon its property. We model an owner as considering the market value and the value of all outstanding City liens against its property (e.g. property tax arrears, water and sewer arrears etc.) when making a decision about whether to abandon its property. An owner who pays all of its back taxes and other outstanding liens is said to redeem its property.[14] A tax delinquent owner

[12] In the absence of transaction costs, if the outstanding loan balance-to-market value ratio were less than one, a wealth maximizing mortgagor would not default because it could sell the property for the market price, pay the remaining balance of the mortgage, and have some money left over. Therefore, defaulting on the mortgage would not maximize wealth. Even if the loan-to-value ratio were greater than 1, a borrower might rationally decide not to default because it expects that its property will appreciate in value in the future. The failure to account for these expectations and risks is the reason why the loan -to- value ratio is a crude estimate of whether a mortgage default option is in the money.

[13] There are theoretical reasons to believe that homeowners do not exercise their mortgage default options as ruthlessly as investors exercise their put options on purely financial assets. When a homeowner defaults on a mortgage, he or she must search for a new place to live, and search is costly. Also the borrower's credit rating would likely be damaged. The transaction costs of moving and reputation costs may prevent mortgagors from exercising their default options ruthlessly. If borrowers do factor transaction and reputation costs into their decisions, then they may not exercise their default options until the loan-to-value ratio is somewhat greater than one. There is some evidence that mortgages defaults are not exercised ruthlessly (Quigley and Van Order, 1992). Therefore, it may take a trigger event like divorce, unemployment, or some other cash flow problem along with a loan to-value ratio greater than one to cause mortgage default.

[14] In New York City, in some instances, delinquent owners may enter into installment agreement with the City to pay any outstanding liens. Therefore, owners who abandoned their properties did not perceive that it was in their interest to enter into an installment agreement, much less pay the full balance of their delinquencies. O'Flaherty (1990) characterizes the amount payable by a tax delinquent owner to redeem a property as an option.

does not have to face a decision to abandon until the relevant municipality threatens to take title to its property. As shown in equation 1, when the local government requires an immediate payment of all outstanding liens, a "ruthless" property owner will abandon its property when the ratio of the value of all city liens against the property to the market value of the property is greater than one.

1) $$\text{ABANDONED}_j = 1, \text{ iff } \alpha_j > 1$$
$$= 0, \text{ otherwise,}$$

where α_j is the lien to value ratio for property j. The act of abandonment yields the building owner a release from all local government liens against his or her property in exchange for the property.[15]

If the actual market value of a property were greater than the dollar amount of all local government outstanding liens, then a rational wealth maximizing property owner would not abandon the property. Even if the owner were able to pay the outstanding taxes or fees because of a cash flow problem, it would sell the property, pay off all lienors, and receive the difference as long as transactions costs were relatively low.

In some cases mortgagees would redeem properties from tax foreclosure when owners would not. For the purposes of the following example, assume that their are no federal or state

[15] Using the mortgage default analogy, a residential property is analogous to a home and a value of all outstanding local government liens is analogous to the value of an outstanding mortgage balance. Under the laws of most states, an action to foreclose a tax lien is an in rem action (i.e. an action "against the thing") and therefore does not subject the owner to personal liability if the value of the property is less than the outstanding debt.

government liens and that it is costless for a mortgagee to sell an abandoned property to a third party. If the sum of the mortgage balance and municipal tax liens is greater than the market value of the property, the owner would not redeem the property. Nevertheless, if the market value of the property were greater than the dollar amount of the municipal liens, the mortgagee would maximize its profit by foreclosing on its loan, purchasing the property at the foreclosure sale, paying the municipal tax liens and then selling the property. Although the outstanding mortgage balance is a consideration for the owner, the outstanding mortgage balance is a sunk cost to the mortgagee. Because mortgagees can redeem tax delinquent properties, we exclude the outstanding mortgage balance from the numerator of the lien-to-value ratio in equation 1.[16]

The measure of the lien- to-value ratio would ideally be a function of all outstanding liens, excluding mortgages, and the true market value of the property. It is safe to assume that owners have more information about the true market value of their properties than local tax assessors.[17] Therefore, in addition to lien-to-value data obtained from public sources, proxies for true property values must be included in the option model of abandonment. For example, characteristics of individual buildings and the neighborhoods in which they are located are likely to be good indicators of the true market values.

Thus, the true lien to-value ratio (α) equals:

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[16] Including federal and state tax liens and transaction costs from property sales in the example does not change its basic implication. The option model of abandonment in this paper can be generalized to both of owner and mortgagee abandonment.

[17] Indeed, O'Flaherty (1990) suggests that it would be "impossible" for a municipality to know the actual market values of individual properties. The measure of market value used in this study is an estimate obtained from the New York City Department of Finance and is described in the next section.

(2) $$\alpha_j = \hat{\alpha}_j + \gamma_j,$$

where $\hat{\alpha}_j$ is the estimate of the lien-to-value ratio obtained from publicly available data and γ_j is the deviation from the true lien-to-value ratio for property j. The sources of the differences between $\hat{\alpha}_j$ and α_j are mainly attributable to incorrect estimates of market value. Variables that are proxies of α_j or its components such as measures of neighborhood characteristics, property - specific disinvestment, or interest by owners, are included in our option model of abandonment. Equation (1) is then modified to become:

3) $$\text{ABANDONED}_j = 1, \text{ iff } Y^*(j) > 0,$$

$$= 0, \text{ otherwise,}$$

where $Y^*(j) = f(\hat{\alpha}_j$, proxies of the true $\alpha_j)$.

IV. Data

Four New York City agencies provided us with physical and financial information for all residential properties in New York City.[18] These data for each property were then merged with 1990 Census tract data. Definitions of all variables are contained in Table 1.

The New York City Department of Finance's RPAD file contains property-level characteristics for all properties in New York City. From the more than 700,000 residential

[18] The New York City agencies that provided the data used in this study are the Department of Housing Preservation and Development, the Department of Finance, the Department of Buildings, and the Department of General Services.

buildings in the 1990 RPAD file, we selected a random 5% sample. After excluding observations because of missing values, our sample included 36,531 non-abandoned properties We added to the sample all properties that were vested by the City of New York in 1990 as a result of an in rem proceeding. This sample is used to estimate the econometric model in Section V.

Table 2 lists each variable used in the econometric model and the summary statistics for abandoned and non-abandoned properties. For abandoned properties, we set the value of ABANDONED equal to "1", and for non-abandoned properties we set the value of ABANDONED equal to "0". Summary statistics of several of the variables in Table 2 are of particular interest. The key variable in our specification of the option theory of abandonment, PUT, equals "1" if the observed lien-to-market value ratio ($\hat{\alpha}$) is greater than "1" and the property is eligible to be vested by the City, and "0" otherwise. Properties with delinquent tax balances for two consecutive years are eligible to be vested by the City of New York. Both the market value estimates and the lien data are obtained from New York City Department of Finance. The total value of liens includes delinquent property taxes, water and sewer liens, ERP liens, and all other liens owing to the City of New York.[19] Table 2 shows that 98% of the abandoned properties had $\hat{\alpha}$ greater than one and were eligible to be vested; fewer than 2% of the non-abandoned properties had lien-to-value ratios above one and were eligible to be vested.

There was not a single property which was abandoned in 1990 that had been altered between 1986 and 1990 or that had obtained a mortgage satisfaction in 1990; the means of

[19] We obtained estimates of outstanding mortgage balances on each property from the New York City Department of Finance, but we do not include this information in the total lien measure because mortgagees are allowed to pay outstanding liens and thereby forestall vesting by the City. See Section III for a further description of this issue. We do not have any information on federal, state, or any other potential outstanding liens.

ALTYR5 and NEWSAT were are both equal to zero.[20] Abandoned buildings tended to be more physically distressed than non-abandoned buildings. Abandoned buildings were more likely to have received maintenance code violations (CODEV) in 1990, 34% to 5%, and were also more likely to have received unsafe building violations (UBVIOL), 11% to 0%. Under New York City's Emergency Repair Program (ERP), tenants may call upon the City to undertake certain maintenance repairs if their landlords are unwilling to do so. Once the work is completed, the City places a lien on the property for the cost of the work done. Among abandoned buildings, 27% had ERP work done in 1990; fewer 2% of the non-abandoned properties had such work done.

Effective tax rates equal the statutory tax rate multiplied by the assessment ratio. The assessment ratios, the assessed value of a property divided by its market value (RASSMKT), of abandoned properties tended to be higher than the assessment ratios for non-abandoned properties, 0.19 to 0.11, respectively. Because of these higher assessment ratios, abandoned properties were subject to higher effective tax rates than non-abandoned properties.

Abandoned buildings also tended to be located more frequently in distressed neighborhoods. The mean poverty rates for the census tracts in which abandoned buildings were located was 33%, compared to only 15% for non-abandoned buildings. The mean percentage of previously abandoned residential buildings (ABRATE) in the census block group for properties abandoned in 1990 was almost 10%. In contrast, the mean percentage of previously abandoned

[20] For dummy variables, variables that are equal to either "0" or "1", such as ALTYR5 or ERP, the mean is equal to the percentage of properties that have values of "1". For example, the mean of ERP for abandoned properties in 0.27. Therefore, 27% of the abandoned properties in the sample had ERP work done on them in 1990.

properties in the neighborhoods of non-abandoned properties was less than 1%.

V. Econometric Model of Landlord Abandonment

A. Model Specification

In this section we specify an econometric model of owner abandonment of residential property that is consistent with the model set forth in Equation (3). We model abandonment decisions by hypothesizing that an owner will abandon its property when doing so increases its net wealth. The dependent variable, $ABANDONED_j$, equals "1" if property j was vested by the City of New York in an in rem proceeding in 1990 and zero otherwise. Theoretically, when required to pay delinquent property taxes or suffer loss of the property's title to the City, the owner of property j will abandon his or her property ($ABANDONED_j = 1$), when the lien-to-value ratio is greater than 1 ($\alpha_j > 1$).[21]

Our principal explanatory variable is PUT, a dummy variable that takes on the value of "1" if the ratio of outstanding City liens to market value is greater than one and "0" if it does not. Since we do not observe all the relevant revenues, costs and market transactions prices associated with each property that would be necessary to accurately estimate true market value and expected wealth under continued ownership, we employ indicators of building quality, neighborhood risk, and property tax burdens, in addition to PUT, as proxy measures for the true lien-to-value (LTV) ratio, α.

[21] For expositional purposes, we refer to delinquent property taxes, but this applies to all City liens, not only property tax liens.

It is likely that an owner and potential mortgagees have better information about the α on individual buildings than is available from public records. Therefore, we include in the econometric model indicators of whether an owner renovated or built an addition onto its building in the five years preceding 1990 (ALTYR5) and whether it obtained a new mortgage (NEWMORT) or satisfied an existing mortgage (NEWSAT). We hypothesize that an owner with α ratios greater than one would be unlikely to pay for alterations to its building or satisfy mortgages. In addition, mortgage lenders would likely avoid making new mortgage loans for buildings with α ratios greater than one.

As indicators of recent disinvestment, we include in our model three indicators of physical distress: the issuance in 1990 of maintenance code violations (CODEV), or the unsafe building code violations (UBVIOL), and an indicator of whether ERP had been performed by the City of New York (ERP). Two identical buildings located in different neighborhoods will have different market values due to varying neighborhood amenities and the risk of future property value fluctuation. We employ two measures of neighborhood quality to proxy for these conditions: the poverty rate for the census tract in which the property was located (POVRATE) and the ratio of already abandoned buildings-to-all buildings in the property's census block. (ABRATE). We expect each of these variables to be positively related to the probability of a building being abandoned.

We include two additional dummy variables in the econometric model to allow for the possibility that ruthless exercises of the abandonment put option might vary across building types. The variable $DAPT_j$ equals "1", if the property is a one or two family dwelling or a walk-up apartment building and "0" if it is not. Presumably, owners of smaller properties (particularly

owner-occupants) would be less willing to give up their properties despite the existence of negative levels of building equity. The variable $DMIXED_j$ equals "1" if the building contains some commercial units and is set equal to "0" if it is entirely residential. An owner of a building with commercial units may be more sophisticated or less affected by subjective considerations and therefore abandon it more ruthlessly than an owner of an all residential structure.

We specify the probability that each property is abandoned to be a function of all the variables listed in Table 2 and an error term that accounts for unobserved property-specific determinants of abandonment. By assuming that the random error term is distributed logistic, the probability that an owner abandons property j, P_j, is equal to

$$4) \qquad P_j = [\exp(X_j\beta) / (1 + \exp(X_j\beta)],$$

where the functional form of the probability, P_j, comes from the logistic distribution of the error term, X_j, contains all of the variables listed in Table 2, and β contains all the coefficients to be estimated.[22]

B. Results

Parameter estimates, t-statistics, and odds ratios from the logistic regression are set forth in Table 3. The estimate of the coefficient on PUT is positive, economically very large, and

[22]This study does not employ a structural model to analyze housing abandonment. Nor do we test for the factors that cause housing disinvestment. The exogenous determinants of housing disinvestment are likely to vary by market and are likely to be difficult to identify since many will be be correlated and the data required to specify a structural model unavailable. In addition, the dataset we use for this paper does not permit us to estimate a proportional hazards model. Future work along these lines is planned.

statistically significant. The odds ratio on PUT equals 878.75, which means that the probability that a property will be abandoned, ceteris paribus, is 878.75 times greater when the ratio of the liens against a property to the property's market value is greater than 1. The marginal effect of PUT on the likelihood of abandonment dwarfs the marginal effects of each of the other regressors. This result yields strong evidence in support of the option theory of abandonment.

The parameter estimates for DAPT and DMIXED are positive but they are economically small and not statistically significant. These estimates therefore do not provide support for the proposition that owners of single family and smaller buildings and owners of buildings without commercial units exercise their abandonment options less ruthlessly than owners of larger buildings and buildings with commercial units.

The effect of the tax assessment ratio, RASSMKT, on the likelihood of abandonment is positive and statistically significant at the 10% level. This result provides evidence that higher assessment ratios contribute to abandonment directly or that higher assessment ratios are proxies for the true market values of properties. If higher assessment ratios are capitalized into market values, then higher assessment ratios will lead to lower market values and consequently higher α's. This would drive the coefficient on RASSMKT toward zero.

As expected, estimates of the effects of ALTYR5, NEWMORT, and NEWSAT are negative and large in absolute value, implying that owners and mortgagees are unlikely to make additional property-specific investments in the years leading up to abandonment of a property. However, the coefficients of these variables are not statistically significant. The odds ratios on ALTYR5 and NEWSAT are equal to zero which indicates that, in our sample, landlords who

altered their properties or satisfied existing mortgages did not abandon their properties.[23]

As expected, each of the three variables that proxy for physical distress have positive and statistically significant parameter estimates. A building that received emergency repairs in 1990 from the City (ERP), was three times more likely to be abandoned than a building that did not. A building which received an unsafe building violation, in 1990, (UBVIOL) from the City was almost seven times more likely to be abandoned than one that received no such violation. Finally, a building that received the less serious housing maintenance code violation (CODEV) was twice as likely to be abandoned.

As expected, the signs for both of the coefficients on the variables measuring neighborhood conditions were positive. A statistically significant relationship exists between the poverty rate in a census tract (POVRATE) and the probability that a building located in that tract will be abandoned. With respect to the proportion of already abandoned buildings in a neighborhood (ABRATE), however, the positive relationship is not statistically significant.

VI. Conclusion

Housing disinvestment is a problem that plagues many large central cities in the United States. In this paper, we examine one extreme manifestation of this process-- the loss of title by owners of residential properties as a result of tax foreclosure. Understanding housing abandonment, as defined in this paper, and being able to forecast which properties are most likely to be affected is of concern to policy analysts for several reasons. Those tax delinquent properties

[23] One of the reasons why the t-statistics on ALTYR5 and NEWSAT are so small is that there are relatively few properties in the sample that are observed to have values of ALTYR5 or NEWSAT equal to one.

that are ultimately not redeemed from tax foreclosure by owners or mortgagees are more costly to cities than those redeemed. Higher levels of delinquent tax balances on these properties deprive financially strapped cities of needed revenues. In addition, abandoned buildings are more likely to be undermaintained and most subject to disinvestment, creating unsafe conditions for residents and negative externalities for the communities in which they are located. In addition, identifying which buildings will not be redeemed prior to tax foreclosure enables local governments to initiate actions against these owners first, thereby mitigating tax losses, property deterioration and neighborhood decline.

In this article, we model the decision to abandon a building as analogous to the exercise of a put option; when the sum of all municipal liens against a property exceeds its market value and when faced with the decision of either paying delinquent taxes or having the City divest it of the building, an owner will choose the latter option. We test this option theory of abandonment using a unique property-specific data set of residential buildings in New York City. Consistent with our hypothesis, we find that whether a property's lien-to-value ratio exceeds one is a highly significant explanatory variable, both statistically and economically, with respect to abandonment providing strong support for the option theory of abandonment..

Table 1

Definitions of Variables in Econometric Model of Abandonment

Dependent Variable

ABANDONED	if went property was vested by the City of New York in 1990 and was never redeemed, then 1; otherwise 0

Independent Variables

RASSMKT	ratio of assessed value to "market value" in 1990
ALTYR5	if altered within 5 years (1986-1990), then 1; otherwise 0
DAPT	if building class C (two family dwellings) or D (walk-up apartments), then 1; otherwise 0
DMIXED	if non-residential units in property, then 1; otherwise 0
ERP	if Emergency Repair Program (ERP) work done in 1990, then 1; otherwise 0
NEWSAT	if there is at least one mortgage satisfaction in 1990, then 1; otherwise 0
NEWMORT	if new mortgage in 1990. then 1; otherwise 0
PUT	if the observed ratio of the outstanding City liens divided by market value is greater than 1 and the property is eligible to be vested, then 1; otherwise 0
POVRATE	ratio of persons below poverty level to total population in Census tract
CODEV	if new code violation issued in 1990, then 1; otherwise 0
ABRATE	Percent of Abandoned Properties in Census Block Group
UBVIOL	if unsafe building violation issued in 1990, then 1; otherwise 0

Table 2: **Summary Statistics Of Abandoned and Non-Abandoned Properties**

Variable*	ABANDONED**	Mean	Standard Deviation	Minimum	Maximum
RASSMKT	1	0.19***	0.22	0.01	1.45
	0	0.11	0.14	0.01	3.64
ALTYR5	1	0.00	0.00	0	1
	0	0.00	0.04		
DAPT	1	0.62***	0.49	0	1
	0	0.20	0.40		
DMIXED	1	0.11***	0.31	0	1
	0	0.05	0.21		
ERP	1	0.27***	0.44	0	1
	0	0.02	0.15		
NEWMORT	1	0.01***	0.08	0	1
	0	0.08	0.27		
NEWSAT	1	0.00	0.00	0	1
	0	0.03	0.16		
CODEV	1	0.34***	0.48	0	1
	0	0.05	0.21		
PUT	1	0.98***	0.15	0	1
	0	0.02	0.05		
POVRATE	1	0.33***	0.15	0.00	0.70
	0	0.15	0.13	0.00	0.95
ABRATE	1	0.10***	0.11	0.00	0.75
	0	0.02	0.05	0.00	1.00
UBVIOL	1	0.11***	0.31	0	1
	0	0.00	0.05		

Notes:

***** Variable definitions are listed in Table 2

****** Summary statistics that correspond to ABANDONED equal to "1" are the summary statistics of abandoned properties, and summary statistics that correspond to ABANDONED equal to "0" are the summary statistics for non-abandoned properties.

******* Mean of abandoned properties is significantly different from mean of non-abandoned properties at 1% level.

Table 3: Econometric Results

Dependent Variable: ABANDONED = 1, if property abandoned in 1990, and 0 otherwise

N = 36,695

Variable+	**Estimate (t-statistic)**	**Odds Ratio++**
INTERCEPT	-9.17** (-17.13)	-
RASSMKT	0.95* (1.80)	2.59
ALTYR5	-15.54 (-0.01)	0.00
DAPT	0.34 (1.29)	1.41
DMIXED	0.42 (1.23)	1.52
ERP	1.31** (4.79)	3.69
NEWMORT	-1.60 (-1.53)	0.20
NEWSAT	-12.47 (-0.02)	0.00
CODEV	0.76** (3.08)	2.13
PUT	6.78** (13.14)	878.75
POVRATE	1.99** (3.34)	7.34
ABRATE	0.22 (0.27)	1.25
UBVIOL	1.94** (5.15)	6.94

Notes:

+ Variable definitions can be found in Table 3.

** Statistically significant at the 1% level.

* Statistically significant at the 10% level

++ Odds Ratios for dummy variables (variables equal to either “0" or “1") are defined as the ratio of the probability that ABANDONED equals “1" conditional on the dummy variable equals “1" divided by the probability that ABANDONED equals “1" conditional on the dummy variable equals “0.” All other variables are held constant at their means. Therefore, an odds ratio less than one implies that, ceteris paribus, the probability of abandonment decreases when the dummy variable equals “1." For continuous variables, the odds ratio is defined as the probability that ABANDONED equals “1" conditional on the variable equaling its mean value plus one standard deviation divided by the probability that ABANDONED equals “1" conditional on the variable equaling its population mean. In general, odds ratios of individual dummy variables are not comparable to the odds ratios of continuous variables.

References

Arsen, David 1992. "Property Tax Assessment Rates and Residential Abandonment: Policy for New York City." *American Journal of Economics and Sociology* 51(3):361-377.

Bach, Victor and Sherece West 1993. "Housing on the Block: Disinvestment and Abandonment Risks in New York City Neighborhoods." *Community Service Society of New York.*

Bender, Bruce 1979. "The Determinants of Housing Demolition and Abandonment." *Southern Economic Journal* 46(2):131-144.

Green, Richard and Michelle White. 1997. Urban Abandonments: A Possible Cause and Consequences (unpublished paper).

James Jr., Franklin. 1980. *Race, Housing Value and Housing Abandonment: A Case Study of Newark.* Doctoral Dissertation Columbia University.

O'Flaherty, Brendan. 1990. "The Option Value of Tax Delinquency: Theory." *Journal of Urban Economics* 28: 287-317.

Quercia, Roberto G. and Michael A. Stegman. 1992. "Residential Mortgage Default: A Review of the Literature. *Journal of Housing Research* 3(2): 341-79.

Quigley, John M. and Robert Van Order. 1992. More on the the Efficiency of the Market For Single-Family Homes: Default. Working paper. University of California Center For Real Estate and Urban Economics.

Schill, Michael H. and Benjamin Scafidi. Forthcoming 1998. Housing Conditions and Problems In New York City. In *Housing and Community Development In New York City: Facing*

the Future. Albany: State University of New York Press.

U.S. General Accounting Office. 1979. *Housing Abandonment: A National Problem Needing New Approaches*. Washington, D.C.: Author.

White, Michelle J. 1986. "Property Taxes and Urban Housing Abandonment." *Journal of Urban Economics* 20:312-330.