Gentrification and the decision to renovate or teardown

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Abstract

Within the neighborhood renewal process, property owners and investors attempt to reverse the decline in the quality of the housing stock and/or correct market obsolescence through redevelopment. However, since the existing improvements can be either redeveloped in part (renovations) or in whole (teardowns), a choice must be made between these two processes. While renovations and teardowns have been studied within the gentrification literature as separate phenomena, this study jointly examines these decisions to provide a better understanding of how and where gentrification occurs. The results show support for the notion that renovations and teardowns occur in spatial clusters, but further refine this finding in that they tend to occur in separate spatial clusters. Additionally, the implicit market prices of the structural attributes of properties purchased for major renovations are shown to be equivalent to teardown sales, where the property is valued only for the underlying land.

Keywords: gentrification, redevelopment, renovation, teardown, renewal

1. Introduction

The literature on urban spatial income patterns has established that the housing location decision for upper-income households is primarily a tradeoff between two dynamic yet opposing forces: minimized commuting costs made possible by living near the CBD versus maximized housing service consumption made possible by newer and larger suburban homes. There is, however, a special case when these opposing forces are aligned to pull upper-income households in the same direction towards the CBD. This occurs through the process of gentrification, which is typically defined as the upper-income resettlement and revitalization of lower-income neighborhoods.

The terms "resettlement" and "revitalization" within this definition emphasize that gentrification is one of many phases in the long-term housing life cycle.[1] According to filtering models, this life cycle begins with some exogenous factor that generates construction of new housing.[2] The passage of time causes housing quality to decline, so the willingness to purchase this housing by any income group will likewise decline. Since housing (and therefore housing quality) is considered to be a normal good, the decline in the bids of high-income households will be greater than that of low-income households, which causes this housing to filter down to a lower income group. This process repeats itself until, at the lowest end of the quality distribution, the housing has reached the end of its useful economic life. With no one left for this housing to filter down to, it is often abandoned and drops out of the housing stock altogether. However, in some areas, this housing is redeveloped through the process of gentrification, thereby leading to a renewal in the neighborhood and resetting the life cycle.

Accordingly, redevelopment is a necessary condition for gentrification.[3] As used in this context, redevelopment is a generic term because the existing structure can be redeveloped either in part or in

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[1] Rosenthal (2008) provides evidence that a complete housing cycle can last up to 100 years.

[2] See for example Smith (1972), Sweeney (1974), Weicher and Thibodeau (1988), Rosenthal (2008), and Brueckner and Rosenthal (2009).

[3] However, it is not a sufficient condition, because some redevelopment occurs through "incumbent upgrading", where existing residents redevelop their property. Since there is no socioeconomic change in the property owner, then incumbent upgrading, by definition, does not lead to gentrification (Helms, 2003).

whole. When redevelopment in part occurs through renovations, the structure itself remains but the interior and/or exterior is substantially remodeled or expanded.[4] When redevelopment in whole occurs through teardowns, the existing structure is completely demolished and a brand new structure is constructed in its place. Since some upper-income households prefer the vintage of historic buildings offered by renovated homes, while others prefer the larger-sized houses and modern architecture typically associated with teardowns, households wanting to increase their consumption of housing services must be choose to either renovate or teardown the existing improvements.

Despite the mutually exclusive nature of the redevelopment decision, most of the prior gentrification literature has examined renovations and teardowns as separate phenomena. As a result, the relationship between these processes has largely been unexplored in academic studies.[5] By jointly examining these processes, this study aims to provide a better understanding of how and where gentrification occurs. Specifically, this study analyzes the determinants of the decision to renovate, teardown, or not redevelop within a polychotomous choice framework based on a data set of single-family residential properties in Miami, Florida from 1999-2002. Since the polychotomous choice framework encompasses the full spectrum of choices, it leads to an unbiased and more efficient estimator compared to dichotomous models used by prior studies, which often ignore important information in the data about the other redevelopment choices.

Furthermore, the current study provides empirical evidence related to the variation in the implicit prices of the structural attributes of properties purchased for redevelopment. Based on Brueckner (1980) and Wheaton (1982), Dye and McMillen (2007) infer that when a home is sold prior to a major renovation, the structural characteristics may have less influence on the sales price than when the home is not renovated subsequent to the sale. In the extreme case, some homes are purchased to undergo

[4] It is important to note that "renovations" (which are also known as "rehabilitations") are not synonymous with "repairs", where only malfunctioning or depreciated structural attributes are restored.
[5] This discontinuity in the literature is most likely the result of non-trivial difficulties in obtaining and merging the necessary data for both renovations and teardowns with a sample of housing transactions.

such extensive remodeling that they are effectively new upon completion. Therefore, the implicit prices of structural attributes of properties sold prior to undergoing major renovations should contribute little to sales price. If true, as has shown to be the case for teardown sales (see Rosenthal and Helsley, 1994), the price of these properties would reflect the price as vacant land. To test for such variation in the implicit prices, this study estimates conditional price equations for teardowns, renovations, and non-redeveloped properties.

Key results from this study can be briefly summarized as follows. The primary differences in the determinants of the redevelopment decision are that the level of housing service provided by the size of the existing structure is important to the renovation decision, while the size of the parcel is relevant to the teardown decision. In addition, the likelihood of both renovations and teardowns is strongly influenced by location and the ratio of land value to total property value. The results also provide some interesting insights into the spatial aspects of the redevelopment decision. In particular, this study provides evidence that renovations and teardowns occur in separate (non-overlapping) spatial clusters.

The study also provides strong support for variation in the price impact of structural attributes based on the changes to the attributes post-purchase. Particularly, the structural attributes of properties purchased for renovation are found to be less valuable than non-redeveloped properties, and properties purchased for major renovations are found to be equivalent to teardown sales, where the property is valued only for the land. These results persist even when controlling for selection bias, demographic variables, neighborhood fixed effects, and market conditions.

The remainder of this paper organized as follows. The next section provides a review of the relevant literature. In sections 3 & 4, a theoretical model of the redevelopment decision is presented and the empirical modeling is discussed. The data are described in section 5. An analysis of the study's results is presented in section 6. The last section offers concluding thoughts.

2. Redevelopment literature review

2.1 Renovation literature

The earliest redevelopment studies analyze data obtained from the U.S. Census Bureau's *Survey of Residential Alterations and Repairs* (SORAR) or the decennial census.[6] Mendelsohn (1977) utilizes SORAR data to conduct an empirical examination of renovations. Although the study is national in scope, the data is lacking many of the explanatory variables typically found in more recent. Nevertheless, it provides evidence that income, owner age, and race are important determinants in the renovation decision.

Using block-level data from the 1970 census, Melchert and Naroff (1987) are able to provide greater spatial focus to their renovation analysis. The authors conclude that changes in the number of family members and neighborhood quality may be more important than the levels of these variables in explaining renovations.

The creation of the more detailed *American Housing Survey* (AHS) by the U.S. Department of Housing and Urban Development (HUD) in 1973, which contained more detailed data regarding renovation activity, led to AHS data becoming the basis for a number of renovation studies. Shear (1983) argues that since homeowners face significant transaction costs when they move, it is unlikely that renovation decisions can be adequately explained without relating it to the move decision. Accordingly, the study examines the decision to move, to stay and renovate, or to do nothing within a multinomial logit model. Montgomery (1992) also uses AHS data to examine the move or renovate decision. The study contributes to the literature by providing evidence that properties undergoing major renovations are found to exhibit selection bias. Baker and Kaul (2002) use changes in the AHS surveys to show that renovation projects are undertaken to modify the home to the evolving composition of the household supporting the earlier work of Melchert and Naroff (1987). Plaut and

[6] SORAR data is available back to 1962. However, the Census Bureau discontinued the survey in 2007.

Plaut (2010) use the 2005 AHS survey to extend the move or renovate analysis by focusing only on major renovations.

More recently, renovation studies have utilized property level transaction data. Mayer (1981) provides a theoretical housing renovation model and focuses on the structural and locational determinants of rental housing renovations. Results indicate that older, smaller, owner-occupied units that are structurally sound and had not been recently renovated are the most likely to be renovated.

Helms (2003) proposes a housing renovation model based on Mayer (1981) and analyzes a detailed parcel-level dataset of residential renovation activity in Chicago, IL. The paper establishes that a property's structural and locational attributes, as well as the demographic characteristics of the surrounding neighborhood, influence the likelihood of renovations. Particularly, older, lower-density housing in older, moderate-density neighborhoods with high median housing value are most likely to be renovated. Renovations are also more likely in areas where the population is well-educated and neighborhoods with high population of blacks and other minorities, but somewhat surprisingly less likely in areas with a high proportion of young adults and neighborhoods of high median incomes.

Culp (2010) examines homeowners who moved within the previous five years to analyze the impact of detailed environmental attributes on the likelihood of performing major renovations. The authors construct an index of detailed environmental measures, which is found to have significant explanatory power in the renovate or move decision.

Helms (2012) explores issues pertaining to the possible endogenous feedback between renovations and neighborhood quality. The study uses a spatial lag model and a rich data set of building-level renovations to demonstrate that neighborhood effects influence the spatial clustering of renovation activity (measured as renovation expenditures per residential building).

2.2 Teardown literature

In their theoretical studies of urban spatial growth, Brueckner (1980) and Wheaton (1982) conclude that redevelopment will occur when the price of land for new development exceeds the price of land in its current use by the cost of demolition. Rosenthal and Helsley (1994) note that this implies properties purchased for redevelopment can be used to estimate the value of vacant urban land, which has made possible urban land value studies where there number of vacant lots is limited. Using single-family residential housing in Vancouver, British Columbia, these authors provide evidence that the price of a property to be demolished upon sale is equivalent to that of the vacant land. Munneke (1996) extends this research based on commercial and industrial properties, and finds that the probability of redevelopment increases as the value of a parcel in its redeveloped state increases relative to its value in its current use.

Weber et al. (2006) study the determinants of tearing down single family residential housing within the context of consumer preferences, neighborhood change, and public policy. Similar to the current study, the paper uses census data from the GeoLytics Neighborhood Change Database to test whether changes or levels of demographic variables offer more explanatory power in models of the teardown decision. The results indicate that building characteristics, changes in ethnicity, and presence near the residential core of a neighborhood may provide the best leading indicators of future physical change in gentrifying areas rather than demographic variables or political jurisdictions.

Dye and McMillen (2007) use single family residential transactions in Chicago and surrounding suburbs to examine the determinants of the teardown decision and to value teardown properties. Prime teardown candidates are found to be small, older, homes near public transportation and traditional village centers. After controlling for selection bias, the conditional price equations for teardown properties confirm that structural variables do not provide statistically significant explanatory power, as predicted by Brueckner (1980) and Wheaton (1982). Additionally, the study tests whether teardown status, which is indicated by the procurement of a demolition permit by the homeowner, may be subject to misclassification. Misclassification may occur because obtaining a permit does not automatically imply that a structure is demolished. Furthermore, the authors suggest that some non-teardown properties may be very similar to teardown properties. Specifically, this may be the case when homes are sold prior to major renovations, where the structures are so extensively renovated that they are effectively brand new. Accordingly, the sale prior to a major renovation is theorized to be little different from a teardown sale. Consistent with this theory, the study provides evidence of a high probability of misclassification in that some non-teardown properties are similar to teardown properties, whereas there is a low probability of misclassification of non-teardowns as teardowns.

McMillen (2008) demonstrates how non-sample information can be used to make efficient use of limited data when a group of variables (in this case, the structural characteristics of teardown properties) are expected *a priori* to provide little explanatory power. Results from this technique suggest that a weighted average of the OLS estimates with and without the structural characteristics as explanatory variables can produce an efficient set of land value estimates within small samples.

McMillen and O'Sullivan (2013) present a theoretical model which implies that the structural characteristics of teardown properties will account for a larger proportion of the sale price the longer the time between the purchase date of the property and the demolition date. The authors use teardown data in Chicago and a parametric duration model to test the model's theoretical predictions. Results from the study confirm that the coefficients of structural attributes vary as expected with the estimated hazard rate of demolition, where the value of structural attributes decreases as the probability of teardown increases, and vice versa.

Within the context of valuing the option to redevelop that is capitalized into home prices, Munneke and Womack (2013) estimate spatial probit models of the teardown decision. Their results indicate that the estimated coefficients on the determinants of redevelopment vary spatially; consistent with the notion of spatial clustering of redevelopment. Furthermore, the study provides additional support for the importance of value in the decision to remove a property's improvements.[7]

3. Theoretical model

Helms (2003) proposes a housing renovation model based on the rental housing capital-stock adjustment model of Mayer (1981). Although the model examines only renovations, it can easily be modified into a more general model which allows for redevelopment to occur through either renovations or teardowns. For tractability, this study will follow the general derivation and notation as used in Helms (2003).

Consider an existing house where k_0 denotes the building's initial (pre-redevelopment) level of housing capital, r_j denotes the level of housing investment made during redevelopment, and j = 1, 2, 3, where 1 = renovation, 2 = teardown, and 3 = non-redeveloped. Because redevelopment occurs through either partial or full demolition of the existing improvements, k_d denotes the level of existing housing capital that is demolished during the redevelopment process. In the renovation case, removal of structural items such as obsolescent roofing, flooring, cabinets, etc. typically implies low k_d, whereas in the case of teardowns, the entire existing structure is demolished implying $k_d = k_0$. Therefore, the post-redevelopment level of housing capital is $k_0 + r_j - k_d$. The post-redevelopment condition of the building is given by the function $c(b, k_0 + r_j - k_d)$, where b is a vector of the existing structural attributes that are unchanged by redevelopment (b = 0 in the case of teardowns). When redevelopment occurs, $c_r > 0$ (subscript denotes partial derivatives), as redevelopment is assumed to always improve the property's condition.

The total housing services provided by a building $h\{q(\bar{q}, l), c(b, k_0 + r_j - k_d)\}$ are a function of structure size q and building condition c. Following Brueckner (1983), building size is expressed as a

[7] Several other studies have examined redevelopment from a generic perspective, concentrating neither on renovations nor teardowns. See for example, Capozza and Li (1994), Childs et al. (1996), and Williams (1997).

function of lot size l and the intensity of physical capital $\bar{q}$ employed per unit of land. Expressed in these terms, the model not only provides a link to prior urban spatial studies but also explicitly accounts for the findings of prior empirical research which find that lot size and intensity of the physical capital are critical determinants of the teardown decision (Dye and McMillen, 2007). Increases in structure size and condition increase the level of housing services, so that $h_q > 0$ and $h_c > 0$. Households choose locational attributes (e.g.: distance to coast and CBD) and neighborhood attributes (e.g.: housing characteristics typical of the neighborhood, as well as the demographic characteristics of neighborhood residents) as separate components of their utility function, which may be written as:

$$u\,[h\{q(\bar{q}, l), c(b, k_0 + r)\}] \equiv v(q(\bar{q}, l), b, r, a, e, t)\ , \qquad (1)$$

where $r = (r_j - k_d)$ is the net housing capital added, a and e represent vectors of locational and neighborhood characteristics, respectively, and t denotes a numeraire composite consumption good.[8]

Household income is denoted as y and the price of capital by p^k, so that the household's budget constraint is $y = t + p^k r$. Utility maximization over t and r yields the first-order condition

$$v_r/v_t = p^k\ , \qquad (2)$$

or $u_h h_c c_k/u_t=p^k$, which indicates that the marginal rate of substitution between redevelopment expenditures and consumption must equal the cost of capital. The household's optimal net housing capital investment r^* can therefore be written as:

$$r^* = r(q(\bar{q}, l), b, a, e, p^k)\ . \qquad (3)$$

Equation 3 shows that net housing capital investment is shown to be a function of the intensity of physical capital employed on the land, lot size, structural attributes that do not change with redevelopment, locational attributes, neighborhood attributes, and the cost of capital. Accordingly, the

[8] The notion that households not only pick a neighborhood for the housing characteristics but also the demographic composition is consistent with the sorting literature.

model provides a theoretical basis for the selection of explanatory variables in econometric models of the redevelopment decision.

Whether and how a household will actually redevelop the structure depends on the magnitude of r_j^*. Therefore, letting $\tilde{r}$ denote the actual level of net housing capital added during redevelopment, it follows that:

$$\tilde{r} = \begin{cases} r_1^* & if\ r_1^* > 0 \text{ and } r_2^* \leq 0 \\ r_2^* & if\ r_2^* > r_1^* \text{ and } r_2^* > 0 \\ r_3^* & \text{otherwise} \end{cases} . \quad (4)$$

Equation (4), which does not make use of the actual level of redevelopment but rather distinguishes between the cases in which $\tilde{r} > 0$ and $\tilde{r} = 0$, motivates the use of a polychotomous-choice model. Accordingly, the decision to redevelop can be written as:

$$I_{si}^* = \omega_s z_{si} + n_{si} \qquad s = 1, 2, 3, \quad (5)$$

where I_{si}^* is the underlying response variable (an index of the choices made), ω_s is a vector of parameters to be estimated, z_{si} represents the structural, locational, neighborhood, and market characteristics that may determine redevelopment, s = 1, 2, 3 (1 = renovation, 2 = teardown, 3 = not redeveloped) denotes the redevelopment status of the property, and $n_{si} \sim N(0, \sigma^2)$. The condition under which the current redevelopment status s is observed may be written:

$$I = s \ \ iff \ \ I_s^* > Max(I_j^*) \qquad j = 1, 2, 3 \ \ j \neq s . \quad (6)$$

A multinomial logit model is used to estimate equation (6). Hausman and Small-Hsiao IIA tests indicate that the IIA assumption holds for the sample used in this study, which makes multinomial logit an appropriate modeling choice.[9]

[9] The IIA assumption states that the error terms cannot be correlated across alternatives within the model.

4. Conditional price equations

Theory implies that the value of to-be-renovated structures should be lower on average than structures that are not renovated due to some combination of physical depreciation, functional obsolescence, and externalities. Furthermore, properties purchased for major renovations (which are redeveloped to the point that the structure is effectively brand new) are thought to be equivalent to teardown sales, where the property is valued only for the underlying land. However, this has not yet been empirically demonstrated.

To test these theories, this paper estimates separate price equations conditional on post-purchase redevelopment status.[10] The total price equation for a property may be written as:

$$P_{si} = \alpha_s + \beta_s x_{si} + v_{si} \qquad s = 1, 2, 3 \tag{7}$$

where P_{si} represents the natural logarithm of the selling price of the ith parcel that is purchased for redevelopment regime s, β_s are the estimated parameters, x_{si} is a vector of exogenous explanatory variables, and $v_{si} \sim N(0, \sigma^2)$.

Within the context of the current study, the price of an individual house can be observed in one of three states of nature: either the house is a renovation (I_i = 1), it is a teardown (I_i = 2) or it is not redeveloped (I_i = 3). From Eq. (6), it follows that:

$$I = s \quad iff \;\; \omega_s z_s > \varepsilon_s \tag{8}$$

where $\varepsilon_s = Max(I^*_j) - \eta_s$. Following Lee (1982, 1983) ε_s can be expressed as a standard normal random variable using the J-factor transformation:

$$J_{si}(\varepsilon_s) = \Phi^{-1}(F_s(\varepsilon_s)), \tag{9}$$

where Φ^{-1} is the inverse of the standard normal distribution function and F_s is the distribution function for the extreme value distribution. Accordingly, the condition stated in (8) may be rewritten as:

[10] McMillen and O'Sullivan (2013) point out that true teardown status is difficult to observe precisely when using building permits. However, this concern should be minimized in the current study because renovation status is actually observed in the panel data identification process of redevelopment, rather than relying on permit data in which redevelopment may or may not immediately occur after the permit is issued.

$$I = s \quad iff \;\; J_s(\omega_s z_s) > J_s(\varepsilon_s) = \epsilon_s^* . \tag{10}$$

The conditional expectation of the error term in the total price equation using this condition may be written:

$$E(\upsilon_{si}|I = s) = -\sigma_s \rho_s \frac{\phi(J_s(\omega_s z_s))}{\Phi(J_s(\omega_s z_s))} = -\sigma_s \rho_s \frac{\phi(J_s(\omega_s z_s))}{F_s(\omega_s z_s)} , \tag{11}$$

where ϕ is the standard normal probability density function, σ_s^2 is the variance of υ_s, and ρ_s is the correlation coefficient between ϵ_s^* and υ_s. Note that in evaluating the conditional expectation of the total price equation, the expected value of the disturbance term given redevelopment regime *s* may not be equal to zero, even though $E(\upsilon_{si}) = 0$. Thus, estimating the total price equation Eq. (7), over each of the *s* sub-samples may lead to biased estimates.

To address this potential problem, the two step procedure of Lee (1982) and Maddala (1983) is utilized, where the inverse Mills ratio is included as an independent variable in the total price equation. More specifically, the conditional expectation of the error term derived in Eq. (11) is added and subtracted from the total price equation, which results in the following model:

$$P_{si} = \alpha_s + \beta_s x_{si} - \rho_s \frac{\phi(J_s(\omega_s z_s))}{F_s(\omega_s z_s)} + \left[\upsilon_{si} + \rho_s \frac{\phi(J_s(\omega_s z_s))}{F_s(\omega_s z_s)}\right] , \tag{12}$$

or more concisely

$$P_{si} = \alpha_s + \beta_s x_{si} - \rho_s \frac{\phi(J_s)}{F_s} + \tau_{si} , \tag{13}$$

where $E(\tau_{si}) = 0$ and the variance of v_{si} is assumed to be equal to 1. The significance of the estimated parameter on the inverse Mills ratio is a test for sample selection bias, which would be present when unobserved characteristics which influence the redevelopment decision also influence the price of the house.[11]

[11] Past redevelopment studies have shown that selection bias can be present in both renovations (Montgomery, 1992) and in teardowns (Dye and McMillen 2007; McMillen 2008).

The total price equation expressed in Eq. (13) can be estimated over each of the s sub-samples once the selection variables are constructed from the maximum likelihood estimates of Eq. (5). Note that the resulting standard errors are corrected for heteroskedasticity prior to hypothesis testing.

To allow for differential pricing of the structural attributes for major and non-major renovations, the dummy variable Ψ_{i} (which is equal to one if a major renovation and zero otherwise) is interacted with each of the property structural attributes for properties that undergo major renovations, and $(1-\Psi_i)$ is interacted with each of the property structural attributes for properties that undergo non-major renovations. A major renovation is defined in this study as a renovation in which 43% or more of the pre-renovation structure value has been replaced during the renovation process. This percentage threshold was determined using a grid-search approach of varying the threshold to find the level that generates the best model fit. The threshold identified is also consistent with the 50% teardown rule imposed by the U.S. Federal Emergency Management Agency (FEMA). In a FEMA-declared disaster, if the cost to repair a structure in a FEMA-declared disaster exceeds 50% of the pre-disaster condition, then the structure must be torn down rather than undergo renovation.[12]

The conditional price equation for renovations reflecting this modification can be written as:

$$E(P_i\,|I=1)=\alpha_1+\beta_1 x_{1i}^{nm}+\gamma_0[x_{1i}^{m}\,(\Psi_i)]+\gamma_1[x_{1i}^{m}\,(1-\Psi_i)]-\rho_1\frac{\emptyset(J_1)}{F_1}+\tau_{1i}\,, \tag{14}$$

where the vector x_{Ii} for renovated properties is partitioned into x_{1i}^{nm} representing a vector of the property's non-malleable physical attributes (such as lot size, location variables, neighborhood variables, etc.) and x_{1i}^{m} representing a vector of the property's malleable structural attributes (such as interior area, the number of bedrooms and bathrooms, etc.) Note that the parameters β for the non-malleable characteristics are set to be equivalent for major and non-major renovations, while the parameters γ vary between major and non-major renovations.

[12] According to FEMA Guidance No. 4511.61 E, "The FEMA regulation [the 50% rule] is based on the finding that when a facility is so severely damaged by a disaster that, not including code triggered upgrades, the cost to repair the damage exceeds 50% of the cost of a new building, it is often justifiable and reasonable to replace the building."

The estimated model for teardown properties can be written as:

$$E(P_i\,|I=2) = \alpha_2 + \beta_2 x_{2i} - \rho_2 \frac{\emptyset(J_2)}{F_2} + \tau_{2i} \ , \qquad (15)$$

while the estimated model for non-redeveloped properties can be written as:

$$E(P_i\,|I=3) = \alpha_3 + \beta_3 x_{3i} - \rho_3 \frac{\emptyset(J_3)}{F_3} + \tau_{3i} \ . \qquad (16)$$

5. Data

This study utilizes improved single family residential sales transactions in the City of Miami (Dade County), Florida from 1999 to 2002.[13] The time frame of the sample was specifically chosen for several reasons. First, popular press stories and various academic studies imply that Miami experienced robust redevelopment activity during this time period. Second, it avoids potentially conflating effects of hurricane-related redevelopment.[14] Third, the time frame allows the study to be conducted within the context of a relatively stable real estate market, avoiding both the excess appreciation in home prices during the mid-2000s and the subsequent collapse in prices during the late-2000s.

The primary data file was obtained from the office of the Miami-Dade County unified government tax assessor. For each property in the county, the file contains physical characteristics, sales transaction data, as well as tax assessed values. For the renovated and teardown properties, all property characteristics are observed prior to redevelopment. Data filters applied to obtain the final sample follow the prior literature. Additionally, levels and percent changes (from 1990 to 2000) in various demographic measures obtained from the GeoLytics Neighborhood Change Database are merged into the dataset at the census tract level.

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[13] This is largely the same sample as used in Munneke and Womack (2013).

[14] The major hurricanes effecting Miami around the sample time period were Hurricane Andrew (Category 4, 1992) and Hurricane Wilma (Category 3, 2005). Hurricane Andrew was particularly destructive, where a significant number of homes across Dade County were damaged or destroyed. Hurricane data was obtained from the NOAA (National Oceanic and Atmospheric Administration).

Of the final sample of 5,496 observations, 592 (11%) are classified as renovations, 403 (7%) are classified as teardowns, and 4,501 (82%) are classified as non-redeveloped. Following Munneke and Womack (2013), renovations and teardowns are identified by constructing a panel data set from the real property tax roll files for Miami-Dade County obtained from the Florida Department of Revenue. This file contains a variety of property-level measures, as well as sales transactions and assessed values. Because the same characteristics are reported for each property each year, a panel data set can be constructed which allows teardowns and renovations to be identified directly from the changing property attributes over time. Complete details of the redevelopment identification procedure are given in the Appendix.

Variable definitions, descriptive statistics, as well as difference in means t-tests for each variable are presented in Table 1. For tractability, the variables have been categorized into three major groups: property, location, and neighborhood. Given the focus of this study, the discussion of Table 1 will concentrate on the results from the difference in means tests.

When properties purchased for renovation are compared to non-redeveloped properties (Column 4), the primary result is that the two groups are statistically different in virtually every variable measured in the table. Most notably, renovations have higher sales prices, which can be attributed to the larger lots, larger interior areas, and slightly greater number of bedrooms and baths. Interestingly, there is no statistical difference in the mean structure age between the groups.

The *TDRULE* variable is constructed by dividing the tax assessed value of land by the total tax assessed value in the year prior to sale. As this ratio approaches 100%, the structure's value approaches economic insignificance and the likelihood of redevelopment should increase. Within the context of renovation, the same relationship should hold. On average, properties targeted for renovation or teardown have higher levels of *TDRULE*.

With regards to location, renovated properties are closer to the CBD, closer to the coast, further away from the airport, and are more likely to be located near Coconut Grove (a trendy retail and residential district) and golf courses than non-redeveloped properties. Therefore, in addition to having a larger lot, renovations appear to have superior location compared to non-redeveloped properties. Furthermore, the Table 1 reveals that either the level or the percentage change in each demographic neighborhood measure is statistically different at the mean, suggesting that these variables may be important determinants of the renovation decision.

When properties purchased for teardown are compared to non-redeveloped properties (Column 5), the key finding that emerges is that teardowns have larger lots, more property value attributable to the lot, as well as superior location (closer to the CBD and coast, further from the airport, etc.) This is particularly evident given the fact that, despite having an older structure that is likely near the end of its economic life, teardowns have an average sales price similar to non-redeveloped properties. As with renovations, the level or percent change in each of the various neighborhood variables are statistically significant. However, unlike renovations, both *NRENN* and *NTEAR* are statistically different at the means. Since these variables measure renovation and teardown activity that occurred in the subject property's immediate neighborhood within three years prior to the sale of the subject property), these findings provide initial evidence that teardowns occur in areas that have experienced redevelopment in the recent past.

When renovations are compared to teardowns (Column 6), the results reveal that on average properties purchased for renovations have larger interior areas with more bedrooms and bathrooms, and are newer than properties purchased for teardowns. All of this positively impacts the relative value of renovated structures over teardown structures. In contrast, teardowns have a greater portion of property value comprised by the value of the lot and have roughly three times the concentration of properties in the top decile of the *TDRULE* measure. Furthermore, both *NRENN* and *NTEAR* are statistically different at the means, which provides preliminary evidence in regards to a spatial relationship between teardowns and renovations.

6. Results

6.1 Multinomial logit models

The decision to renovate, teardown, or not redevelop is modeled in this study using a multinomial logit model. The model estimates are presented in Table 2. For comparison purposes, the table also contains estimates of the marginal effects of each variable.

Of particular interest in this study, the value of a property's improvements plays an important role in the decision to redevelop a property. More specifically, as the value of land increases relative to the overall property value (an increase in *ln*(*TDRULE*)), the probability of renovating (or tearing down) a property increases. This relationship is positive and significant for both renovation and teardown regimes. The estimates further indicate that the probability of renovation falls for properties in the top decile of *TDRULE* (captured by *TDRULE TOP*), while the probability of tearing down the property increases with this variable. These results clearly show that when a property's physical capital has depreciated beyond a point, the physical capital is replaced by tearing it down. However, prior to this point, physical capital is updated through renovation.

In regards to physical property characteristics in the renovation model, the coefficient estimate on *ln*(*INTERIOR AREA*) is positive and significant, indicating that larger homes are more likely to be renovated.[15] This is not a surprising result if renovations are a means to improve the currently existing space rather than a method used to substantially increase the floor area. The positive and negative coefficients on *AGE* and AGE^2 respectively imply that the likelihood of renovations increases as the structure ages, but at some point the increasing age eventually deters renovations.

[15] It should be noted that when *ln*(*TDRULE*) and *TDRULE TOP* are omitted from the model, both *ln*(*LOT AREA*) and *ln*(*INTERIOR AREA*) are positively and negatively statistically significant, respectively. Furthemore, variance inflation factor tests indicate that mutlicolinearity in the model specification is not significant (VIFs are all less than the standard critical value of 5).

In regards to the location variables, only two of the five measures are significant. *DIST FROM CBD* and *DIST FROM COAST* are both negative and significant, indicating that the probably of renovation increases as the distance from the CBD and coast decreases.

Many of the neighborhood variables show a significant impact on the decision to renovate a property. The negative coefficient on *POPULATION%Δ* is consistent with the notion that renovations may occur in lower density areas. Both *ln(MEDFAMINC)* and *MEDFAMINC%Δ* are positive and significant, implying that neighborhoods that are already or are becoming more affluent may encourage renovations. The results of the educational variables are mixed in that *COLLEGE* is negative but *COLLEGE%Δ* is positive. The results of the racial variables are also mixed, where the levels of *BLACK* and *HISPANIC* are negative and significant, but *BLACK%Δ* is positive and *HISPANIC%Δ* are statistically insignificant.[16]

As expected, the coefficient on *NRENN* is positive and significant, implying that renovations occur in neighborhoods that have already experienced renovation activity in the recent past. However, the negative coefficient on *NTEAR* indicates that the presence of prior teardowns in the neighborhood decreases the probability of renovations. The negative and statistically significant interaction term *NRENN*NTEAR* implies that there is a negative correlation between the number of nearby renovations and teardowns.

Collectively, these findings are consistent with the notion that if renovations occur in a neighborhood, it is unlikely that the same neighborhood will also experience teardowns, and vice versa. In other words, if neighborhoods are homogeneous in regards to most attributes, the housing life cycle implies that redeveloping neighborhoods should primarily experience one form of redevelopment or the other, but typically not both at the same time.[17]

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[16] According to the 2000 Census, the city of Miami had a population of approximately 2.2 million and was 57% Hispanic, 20% Black, and 23% White (non-Hispanic).

[17] However, this may not be the case in areas that have regulatory, physical, or other constraints on redevelopment.

In the model of the teardown decision, theory implies that the proxies for the optimal redevelopment rule should be the primary determinants of teardowns. As expected, both variables are positive and significant, with very few property variables other than *AGE* remaining significant.

The location variables also have substantial explanatory power. The positive coefficients on *CGROVE* and *GOLF* imply that properties located in these trendy retail and residential areas increase the likelihood of teardowns, as does being located near recreational amenities such as golf courses.

The neighborhood variables for population, median family income, and education are very similar to the results from the renovation model. Notable differences are that the racial demographic variables do not seem to influence the likelihood of teardown (which may explain why most teardown determinant studies have omitted these variables), and that *NRENN* has a statistically insignificant effect on teardowns, while *NTEAR* has a positive effect. These results are consistent with the findings from the renovation model, in that teardowns occur in areas that have experienced prior teardowns, but not in areas of prior renovations.

Given the importance of location to the redevelopment decision and given that it is likely that some idiosyncratic location and neighborhood attributes may be unobserved or are measured imperfectly, a second model of the redevelopment decision is presented in Table 3. The specification of this model is the same as that of Table 2, with the addition of thirteen neighborhood dummy variables as a control for spatial fixed effects.[18] Furthermore, because it is possible that the demographic variables may be serving as proxies for location (filtering models suggest that many neighborhoods tend to be demographically homogenous), this specification should also help untangle the influence of demographics from their neighborhood proxy effect.

Many of the results from the fixed effects model are quite similar to that of the prior model, thus the discussion of the results will focus only on the significant differences. In the renovation model of

[18] The neighborhoods are defined by the City of Miami Tax Assessor's Office. The omitted neighborhood in the model is a large coastal-oriented neighborhood in north Miami.

Table 3, all property variable coefficients retain the same signs and their statistical significance, except for *AGE*, AGE^2, and *TDRULE TOP* which fall insignificant. These results are consistent with the homogeneity of structure age within neighborhoods. Many times, including neighborhood fixed effects can capture some of the explanatory power of the other locational variables.[19] This appears to be the case in the current study, as *DIST FROM CBD* and *DIST FROM COAST* both fall insignificant, although *CGROVE* remains significant. Providing support to the notion that demographics may capture idiosyncratic household preferences regarding redevelopment, all neighborhood variables retain their sign and significance, except for *COLLEGE* and *BLACK*. In regards to the neighborhood fixed effects, only two are statistically significant. These results imply that renovations are not ubiquitous, but rather only occur in certain locations within the urban space.

In the teardown model of Table 3, the only change in the property variables is that *AGE* loses significance. The variables *ln*(*LOT AREA*), *ln*(*TDRULE*) and *TDRULE TOP* remain significant with the expected signs, even in the presence of the neighborhood fixed effects. As was the case for renovations, the location variables *DIST FROM CBD* and *DIST FROM COAST* fall insignificant. However, a different finding is that the dummy variable *CGROVE* becomes insignificant while *GOLF* becomes positive and significant. Results for the neighborhood variables are largely unchanged.

6.2 Conditional price equations

To provide an empirical test of the possible variation in implicit market prices of the structural attributes of renovation and teardown properties, this study estimates three separate hedonic models conditional on the property's redevelopment status. The conditional price equations are specified to include all of the variables used in the multinomial logit model with fixed effects (Table 3), except for *ln*(*TDRULE*), *TDRULE TOP*, *NRENN*, *NTEAR*, and *NRENN***NTEAR* (which are theoretical

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[19] For example, in Weber (2006) most significant locational variables become insignificant when fixed effect variables are added.

determinants of the teardown decision rather than property value). Additionally, quarterly time dummies and a selection variable (formed from the multinomial logit model with fixed effects) are included in the house price models. In order to capture transactions where properties are purchased for redevelopment, the study follows prior literature by including only properties sold within the two years prior to redevelopment in the renovation and teardown price equations (which decreases the sample sizes).

Results from the estimated hedonic models are reported in Table 4. Because the theory being tested concerns only the value of land and the physical attributes, results for all other variables are suppressed. In the first model of Table 4, the results indicate that the property attributes of non-redeveloped properties exhibit the typical values found in most urban housing studies. Housing characteristics that add value, such as *ln*(*LOT AREA)* and *ln*(*INTERIOR AREA*), are positive and significant, while those that decrease value, such as *AGE*, are negative and significant. In fact, all of the structural attributes (defined as *ln*(*INTERIOR AREA*), *BEDROOMS*, *BATHROOMS*, *AGE*, AGE^2) are statistically significant. As a result, it is not surprising that the F-test of the null hypothesis that the structural attributes are jointly insignificantly different from zero is rejected.

In the renovation price model of Table 4, properties have been classified based on the intensity of redevelopment. For major renovations (where 45% or more of the structure value has been replaced during the renovation process), a dummy variable Ψ_i (equals one if a major renovation and zero otherwise) has been interacted with each of the property's structural attributes. Similarly, for non-major renovations, each of the property's structural attributes have been interacted with the term (1-Ψ_i). This specification allows, but does not force, the implicit prices of the structural attributes to vary between major and non-major renovations.

Results from this specification indicate that the interaction terms for the major renovation structural attributes are statistically insignificant, while the interaction terms for non-major renovations remain significant. In addition, based on an F-test, we fail to reject the null hypothesis that the structural attributes for major renovations are jointly insignificantly different from zero at the standard 5% level, while the null is rejected for non-major renovations. These results provide evidence that properties purchased for major renovations are similar to teardown sales, where the property is valued only for the underlying land. Furthermore, the magnitude of the coefficients for non-major renovations suggests that properties purchased for renovations are in many ways "in-between" non-redeveloped properties and teardowns.

In the teardown price model, the only property attribute of teardowns that is statistically significant is *ln(LOT AREA)*. In addition, we fail to reject the null hypothesis that the structural attributes are jointly insignificantly different from zero, based on an F-test. These findings reaffirm the theory that properties purchased for immediate teardown are valued only for the underlying land.

Finally, as a robustness test of one of the primary findings in this paper, major renovations are merged with teardowns and a single conditional price equation is estimated across the two groups. Results from this test (not reported in table form) are very similar to the teardown results from Table 4, where the structural attributes remain statistically insignificant both on an individual and a joint basis. These results provide strong support that properties purchased for major renovations are similar to teardown sales.

7. Conclusion

When gentrification occurs, low quality housing approaching the end of its economic useful life is redeveloped either in part or in whole into a new or like-new structure, thereby restarting the life cycle of housing once more. If homeowners choose to renovate the existing improvements, the structure itself remains but the interior and/or exterior is substantially remodeled or expanded. In contrast, if homeowners decide to teardown the existing improvements, the entire structure is demolished and a brand new structure is constructed in its place.

Despite the mutually exclusive nature of the redevelopment decision, most of the prior gentrification literature has examined renovations and teardowns as separate phenomena. As a result, the relationship between these processes has largely been unexplored in academic studies. Therefore, to provide a better understanding of how and where gentrification occurs, this study examines the relationship between renovations and teardowns using a polychotomous choice model and a set of conditional price equations.

Results from the models of the redevelopment decision provide several notable findings. The primary differences in the determinants of renovations and teardowns appear to be variables relating to the size, age, and configuration of the improvements. These results indicate that the existing level of housing services provided by the existing structure is important to renovations, but not to teardowns. Particularly, homes offering greater opportunities for post-renovated space are more likely to be renovated, whereas the size of the lot is less important. This is not a surprising result if most renovations do not involve a substantial increase in the floor area, but rather occurs as a means to improve the currently existing space. In contrast, location, lot size, and the ratio of lot value to total property value are the most critical determinants of teardowns.

One of the notable similarities in the determinants of the redevelopment decision is the importance of location. While renovations and teardowns are both found to occur in spatial clusters, this study provides evidence that they occur in separate clusters. In fact, the presence of recent teardowns in a neighborhood lowers the probability of renovations in that neighborhood, and vice versa. This result is plausibly attributed to the homogeneous distribution of housing attributes within, but not among, neighborhoods.

Another notable similarity is the importance of the proxy variable for the optimal teardown rule (the ratio of land value to total property value) in the redevelopment decision. This variable is found to offer substantial explanatory power for both teardowns and renovations. The statistical significance of this variable with respect to teardowns was expected, but the extension of this theory to a renovation context contributes to the literature by confirming that renovations occur as a means of replacing worn out physical capital.

The final notable similarity is that changes in demographic variables offer more explanatory power than the levels of those variables for both renovations and teardowns. However, these variables offer greater explanatory power in the model of the renovation decision than in the teardown decision. This finding is consistent with the notion that teardowns are primarily determined by the optimal teardown rule.

Results from the conditional price equations estimated in this study provide two additional important results. First, the structural attributes of renovations are found to be less valuable than non-redeveloped properties. This finding supports the theory that structures purchased for renovations are of lower quality (due to some combination of physical depreciation, functional obsolescence, and externalities) on average than structures that are not renovated. Second, properties purchased for major renovations (redeveloped to the point that the structure is effectively brand new) are found to be equivalent to teardown sales, where the property is valued only for the underlying land.

Overall, results from this study contribute to the literature by providing a better understanding of how and where gentrification occurs, and by revealing the variation in the implicit prices of structural attributes of properties purchased for redevelopment.

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Appendix – Redevelopment identification

This appendix details the panel data approach utilized in this study to identify teardown and renovated properties. Although most redevelopment studies use building permits to identify redevelopment, the permit data obtained from the City of Miami Building Department was deemed to be incomplete. Therefore, a panel data set is constructed from the real property tax roll files for Miami-Dade County (obtained from the Florida Department of Revenue) in order to identify a more complete list of redeveloped properties.

The file contains a variety of property-level measures such as year built, effective year built, interior area, lot size, land use, and the value of any improvements constructed or demolished during the year (which is based on building permit data obtained by the tax assessor's office), as well as sales transactions and assessed values. Because the same characteristics are reported for each property each year, a panel data set can be constructed which allows teardowns to be identified directly from the changing property attributes.

A property is identified as a teardown if one of the following four conditions is satisfied. An illustration of this approach, as well as some of the key data fields contained in the dataset, is provided in Table A.1.

Condition 1: If 50% or more of the previous year's structure value is demolished.

Condition 2: If the state land use code changes from improved residential or improved commercial to vacant residential.

Condition 3: If year built changes to the contemporaneous tax roll year and interior area is not equal to the previous year's interior area and some structure value has been removed (all of which must occur in the same year).

Condition 4: If the property is on the demolition permit file obtained from the City of Miami Building Department.

A property is identified as a renovation according to the following algorithm. The total amount of structure value added for each property (as identified by the Miami-Dade County Tax Assessor) is summed from the first year of renovation activity until 2004. If this sum is greater than $2,000 the sum is then divided by the building assessed value in the year prior to the first year of renovation activity to calculate the "renovation ratio". If the renovation ratio is greater than 2% and the following filters are met (state land use code must indicate improved single family, last sales price > $50,000, building assessed value > $25,000, interior area > 300 sf, lot size > 1,500 sf), then the observation is classified as a renovation. An illustration of this approach is provided in Table A.2.

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Table 1
Variable definitions, descriptive statistics, and difference in means tests

Variables	Variable Definitions	(1) Non-Redeveloped Mean	(1) Non-Redeveloped Std Dev	(2) Renovations Mean	(2) Renovations Std Dev	(3) Teardowns Mean	(3) Teardowns Std Dev	(4) Diff (2) - (1) |t-value|	(5) Diff (3) - (1) |t-value|	(6) Diff (2) - (3) |t-value|
Observations	Total sample contains 5,496 transactions	4,501		592		403				
Property										
SALES PRICE	Sales price of the house	182,053	212,658	205,700	193,200	195,377	172,786	2.57 **	1.22	0.86
TDRULE	Assessed land value divided by assessed total value (in the year of sale)	0.47	0.14	0.49	0.14	0.53	0.17	3.20 ***	8.07 ***	4.17 ***
TDRULE TOP	1 if *TDRULE* is in the highest 10^{th} percentile, 0 otherwise	0.09	0.28	0.09	0.29	0.25	0.43	0.59	10.58 ***	6.77 ***
LOT AREA	Lot size (square feet)	7,080	3,050	8,147	3,919	8,213	4,306	7.72 ***	6.87 ***	0.25
INTERIOR AREA	Interior area (square feet)	1,667	776	1,879	807	1,715	961	6.05 ***	1.16	2.92 ***
BEDROOMS	Number of bedrooms	2.69	0.84	2.84	0.87	2.64	0.94	3.86 ***	1.17	3.35 ***
BATHROOMS	Number of bathrooms (half bath = .5)	1.65	0.85	1.82	0.90	1.65	0.96	4.39 ***	0.05	2.74 ***
AGE	Structure age in 1999 (calculation: 1999 - year built)	51.68	15.35	51.76	14.40	55.12	12.96	0.01	4.37 ***	3.86 ***
Location										
DIST FROM CBD	Miles from the central business district	3.91	1.48	3.77	1.38	3.74	1.33	2.22 **	2.31 **	0.39
DIST FROM COAST	Miles from the coastline minus 1 if < 1 mile, 0 otherwise	(0.28)	0.34	(0.40)	0.35	(0.38)	0.34	7.68 ***	5.30 ***	1.01
DIST FROM MIA	Miles from Miami International Airport minus 1 if < 1 mile, 0 otherwise	(0.00)	0.03	(0.01)	0.04	(0.01)	0.05	2.99 ***	2.93 ***	0.23
CGROVE	1 if located within Coconut Grove, 0 otherwise	0.09	0.28	0.10	0.30	0.18	0.39	0.86	6.52 ***	4.03 ***
GOLF	1 if located within .5 miles of a golf course, 0 otherwise	0.03	0.17	0.07	0.25	0.08	0.27	4.81 ***	5.08 ***	0.56
Neighborhood										
POPULATION	Total population in 2000 (census tract)	5,872	1,881	5,579	1,831	5,506	1,819	3.64 ***	3.86 ***	0.63
POPULATION%Δ	% change in *POPULATION* from 1990 to 2000	0.02	0.10	0.04	0.14	0.02	0.13	2.93 ***	0.29	1.74
MEDFAMINC	Median family income in 2000 (census tract)	35,780	23,840	41,076	26,143	40,936	27,731	5.02 ***	4.10 ***	0.08
MEDFAMINC%Δ	% change in *MEDFAMINC* from 1990 to 2000	0.46	0.72	0.74	1.60	0.69	1.29	7.45 ***	5.78 ***	0.50
COLLEGE	% persons 25+ with bachelors degree in 2000 (census tract)	0.22	0.19	0.26	0.20	0.27	0.21	5.16 ***	4.90 ***	0.41
COLLEGE%Δ	% change in *COLLEGE* from 1990 to 2000	0.31	0.31	0.33	0.26	0.33	0.30	1.54	1.27	0.02
BLACK	% population Black or African American in 2000 (census tract)	0.18	0.29	0.16	0.25	0.19	0.28	1.16	0.97	1.71
BLACK%Δ	% change in *BLACK* from 1990 to 2000	0.67	1.37	0.83	1.67	0.69	1.49	2.63 ***	0.27	1.38
HISPANIC	% population Hispanic or Latino in 2000 (census tract)	0.63	0.33	0.58	0.31	0.56	0.32	3.33 ***	4.41 ***	1.35
HISPANIC%Δ	% change in *HISPANIC* from 1990 to 2000	0.10	0.26	0.09	0.19	0.12	0.26	0.67	2.07 **	2.48 **
NRENN	# of sales that are renovations within .75 miles that occurred during the 3 years prior to the sale of the subject property	29.92	32.12	32.13	31.51	36.51	40.06	1.60	3.86 ***	1.97 **
NTEAR	# of sales that are teardowns within .75 miles that occurred during the 3 years prior to the sale of the subject property	4.96	6.59	4.84	6.48	6.45	7.75	0.42	4.29 ***	3.55 ***

This table provides definitions, descriptive statistics, and difference in mean tests for the variables utilized in the econometric models. Each observation in the sample is classified as a renovation (where the existing structure remains but has been significantly improved), teardown (where the existing structure is demolished in anticipation of redevelopment), or non-redeveloped (where the property has not been renovated or torndown). For the renovation and teardown observations, all property and sale attributes are observed prior to redevelopment. The reported t-values are based on the results of a variance equality test between the groups for each variable (most variances were found to be unequal). The symbols *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 2
Multinomial logit model of the redevelopment decision

Variable	Renovate Coeff	Renovate Marg. Effect	Renovate |z-value|		Teardown Coeff	Teardown Marg. Effect	Teardown |z-value|	
Property								
ln(TDRULE)	1.248	0.104	4.68	***	1.069	0.058	3.40	***
TDRULE TOP	-0.309	-0.034	1.67	*	0.656	0.045	3.61	***
ln(LOT AREA)	0.063	0.001	0.32		0.563	0.036	2.57	**
ln(INTERIOR AREA)	1.128	0.100	4.62	***	0.261	0.007	0.93	
BEDROOMS	0.073	0.007	0.96		-0.087	-0.006	0.94	
BATHROOMS	-0.185	-0.017	2.07	**	0.043	0.004	0.40	
AGE	0.026	-4E-04	1.95	*	0.033	0.001	1.77	*
AGE^2	-3E-04		2.06	**	-2E-04		1.28	
Location								
DIST FROM CBD	-0.107	-0.009	2.41	**	-0.116	-0.006	1.96	*
DIST FROM COAST	-0.928	-0.077	4.23	***	-0.835	-0.046	3.22	***
DIST FROM MIA	0.650	0.052	0.39		0.771	0.044	0.42	
CGROVE	-0.259	-0.031	0.97		0.822	0.055	3.07	***
GOLF	0.541	0.036	1.36		1.176	0.071	2.57	**
Neighborhood								
POPULATION	2E-05	0.000	0.42		6E-05	0.000	1.51	
POPULATION%Δ	-3.073	-0.238	3.64	***	-4.760	-0.279	5.04	***
ln(MEDFAMINC)	2.030	0.178	5.35	***	0.800	0.034	1.95	*
MEDFAMINC%Δ	0.290	0.023	3.39	***	0.357	0.020	3.88	***
COLLEGE	-8.271	-0.742	5.14	***	-1.200	-0.005	0.63	
COLLEGE%Δ	0.950	0.081	4.08	***	0.658	0.034	2.71	***
BLACK	-2.052	-0.205	1.55		2.132	0.155	1.38	
BLACK%Δ	0.102	0.009	2.39	**	0.032	0.001	0.57	
HISPANIC	-2.767	-0.263	2.35	**	1.274	0.106	0.91	
HISPANIC%Δ	0.348	0.028	1.11		0.380	0.021	1.25	
NRENN	0.013	0.001	2.47	**	-0.010	-0.001	1.54	
NTEAR	-0.057	-0.007	2.62	***	0.041	0.004	1.67	*
*NRENN*NTEAR*	-3E-04		1.79	*	2E-04		0.91	
Other								
Intercept	Yes							
N	5,496							
Log-Likelihood	-3018.18							

This table reports results from the multinomial logit model of the decision to renovate, teardown, or not redevelop (which is the omitted category). The symbols *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 3
Multinomial logit model of the redevelopment decision with neighborhood fixed effects

	Renovate				Teardown			
Variable	Coeff	Marg. Effect	|z-value|		Coeff	Marg. Effect	|z-value|	
Property								
ln(TDRULE)	1.488	0.122	5.34	***	1.366	0.074	4.17	***
TDRULE TOP	-0.277	-0.030	1.48		0.602	0.041	3.25	***
ln(LOT AREA)	-0.072	-0.011	0.37		0.492	0.032	2.20	**
ln(INTERIOR AREA)	1.246	0.109	4.98	***	0.349	0.011	1.22	
BEDROOMS	0.083	0.008	1.08		-0.073	-0.005	0.77	
BATHROOMS	-0.203	-0.018	2.25	**	0.005	0.002	0.05	
AGE	0.017	-0.001	1.29		0.028	4E-04	1.47	
AGE^2	-2E-04		1.56		-2E-04		1.12	
Location								
DIST FROM CBD	-0.082	-0.006	0.89		-0.132	-0.008	1.18	
DIST FROM COAST	0.095	0.010	0.29		-0.127	-0.009	0.34	
DIST FROM MIA	1.058	0.085	0.63		1.171	0.065	0.65	
CGROVE	-1.699	-0.154	3.79	***	0.040	0.018	0.10	
GOLF	0.181	0.008	0.44		0.920	0.057	1.84	*
Neighborhood								
POPULATION	5E-05	0.000	1.09		1E-04	0.000	2.60	***
POPULATION%Δ	-2.632	-0.198	2.19	**	-4.430	-0.260	3.76	***
ln(MEDFAMINC)	1.423	0.124	3.45	***	0.458	0.017	1.01	
MEDFAMINC%Δ	0.387	0.031	3.48	***	0.426	0.024	3.73	***
COLLEGE	-3.327	-0.308	1.46		0.883	0.086	0.32	
COLLEGE%Δ	0.742	0.062	2.73	***	0.534	0.028	1.93	*
BLACK	-1.323	-0.131	0.78		1.376	0.100	0.68	
BLACK%Δ	0.102	0.009	2.17	**	0.050	0.002	0.84	
HISPANIC	-2.035	-0.204	1.15		2.336	0.167	1.10	
HISPANIC%Δ	0.252	0.021	0.65		0.153	0.008	0.44	
NRENN	0.012	0.001	1.98	**	-0.006	0.000	0.88	
NTEAR	-0.059	-0.007	2.49	**	0.034	0.003	1.25	
*NRENN*NTEAR*	-3E-04		1.75	*	8E-05		0.40	
Neighborhood Fixed Effects								
NH91 - NORTHERN COAST	0.254	0.019	0.51		0.466	0.027	0.90	
NH92 - WEST	-0.845	-0.080	1.33		0.473	0.038	0.80	
NH93 - WEST	-0.333	-0.020	0.55		-1.077	-0.066	1.67	*
NH94 - CENTRAL	0.032	0.004	0.06		-0.105	-0.007	0.19	
NH98 - HOTEL DISTRICT	-1.274	-0.112	1.88	*	-0.293	-0.007	0.46	
NH99 - CENTRAL	-0.626	-0.044	0.74		-1.347	-0.081	1.57	
NH100 - NEAR AIRPORT	0.390	0.044	0.50		-1.012	-0.068	1.20	
NH101 - NEAR AIRPORT	-0.840	-0.058	1.09		-2.009	-0.121	2.42	**
NH102 - NEAR AIRPORT	-0.878	-0.066	1.29		-1.535	-0.090	2.16	**
NH103 - SOUTH CENTRAL	-0.735	-0.051	1.13		-1.707	-0.102	2.55	**
NH104 - SOUTH CENTRAL	-0.605	-0.042	0.95		-1.371	-0.082	2.11	**
NH105 - SOUTH	-1.560	-0.127	3.93	***	-1.560	-0.086	3.46	***
Other								
Intercept				Yes				
N				5,496				
Log-Likelihood				-2986.69				

This table reports results from the multinomial logit model of the decision to renovate, teardown, or not redevelop (which is the omitted category). The neighborhood fixed effects are normalized with respect to a large coastal neighborhood in north Miami. The symbols *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 4
Conditional price equations

Dependent = *ln(SALES PRICE)*

Variable	Non-Redeveloped Coeff	Non-Redeveloped |t-value|	Renovations Coeff	Renovations |t-value|	Teardowns Coeff	Teardowns |t-value|
Intercept	Yes		Yes		Yes	
ln(LOT AREA)	0.247	10.68 ***	0.396	4.71 ***	0.659	3.80 ***
ln(INTERIOR AREA)	0.447	23.56 ***			0.101	0.70
BEDROOMS	-0.020	2.55 **			-0.018	0.37
BATHROOMS	0.083	8.84 ***			0.085	1.50
AGE	-0.007	4.86 ***			0.014	1.11
AGE^2	5E-05	3.64 ***			-1E-04	0.93
*ln(INTERIOR AREA)*Ψ*			0.051	0.18		
ln(INTERIOR AREA)(1-Ψ)*			0.331	2.62 ***		
*BEDROOM*Ψ*			-0.062	0.36		
BEDROOM(1-Ψ)*			-0.042	1.20		
*BATH*Ψ*			0.108	0.61		
BATH(1-Ψ)*			0.099	2.02 **		
*AGE*Ψ*			0.042	0.66		
AGE(1-Ψ)*			-0.012	1.89 *		
$AGE^2 *\Psi$			-2E-04	0.43		
$AGE^2 *(1-\Psi)$			9E-05	1.30		
Location variables	Yes		Yes		Yes	
Neighborhood variables	Yes		Yes		Yes	
Neighborhood fixed effects	Yes		Yes		Yes	
Quarterly time dummies	Yes		Yes		Yes	
Selection bias correction	0.102	1.21	-0.035	0.18	0.459	1.79 *
N	4,501		210		136	
R^2	0.826		0.865		0.896	
F-test structure = 0	272.57***		*Ψ* =2.18, (1-Ψ)=9.34***		1.44	

This table reports results from the price equations, which are conditional on redevelopment status. Following prior literature, properties are required to have been sold within the two years prior to redevelopment, which decreases the sample size of renovations and teardowns. The dependent variable is *ln(SALES PRICE)*. For the renovation and teardown observations, all property and sale attributes are observed prior to redevelopment. The reported t-values are calculated using heteroskedastic robust standard errors. *Ψ* is a dummy variable that equals 1 if a major renovation (where renovation costs exceed 43% of the pre-renovated structure value), 0 otherwise. Location, neighborhood, neighborhood fixed effects, and quarterly time dummy variables are included in each of the models but their results have been suppressed. The null hypothesis that the coefficients of the structural attributes for major renovations are jointly equal to zero fails to be rejected by the F-test at the 5% level. An F-test also fails to reject that the structural attribute coefficients for teardowns are jointly equal to zero. The symbols *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table A.1
Teardown identification example

PROPERTY IDENTIFICATION NUMBER	*TAX ROLL YEAR*	*STATE LAND USE CODE*	*TOTAL ASSESSED VALUE*	*LAND ASSESSED VALUE*	*STRUCTURE ASSESSED VALUE*	*STRUCTURE VALUE ADDED OR (REMOVED)*	*YEAR BUILT*	*INTERIOR AREA*	*LOT SIZE*
0132190081050	1999	01	$ 255,296	$ 138,188	$ 117,108	$ -	1960	3,002	19,960
0132190081050	2000	01	$ 306,636	$ 169,595	$ 137,041	$ -	1960	3,002	19,960
0132190081050	2001	01	$ 341,037	$ 186,554	$ 154,483	$ -	1960	3,002	19,960
0132190081050	2002	01	$ 361,611	$ 239,520	$ 122,091	$ -	1960	3,002	19,960
0132190081050	2003	00	$ 359,280	$ 359,280	$ -	$ (122,091)	.	.	19,960
0132190081050	2004	00	$ 395,208	$ 395,208	$ -	$ -	.	.	19,960
0132190081050	2005	01	$ 1,480,478	$ 572,852	$ 907,626	$ 907,626	2004	5,974	19,960

This table provides an example of the panel data approach used to identify teardown properties in this study. The table reports a sub-sample of data fields contained in the original files obtained from the Florida Department of Revenue (some variable names have been changed for tractability). Since each variable is observed for each property in the sample for each year, teardowns can be identified directly within the dataset by examining changes in these variables. A brief explanation of some of the variables follows. *STATE LAND USE CODE*: "01" indicates improved single family residential and "00" indicates vacant residential. *STRUCTURE VALUE ADDED OR (REMOVED)*: a positive number indicates the value of new improvements added to the property, while a negative number indicates the value of improvements that were demolished.

Table A.2
Renovation identification example

PROPERTY IDENTIFICATION NUMBER	*TAX ROLL YEAR*	*STATE LAND USE CODE*	*TOTAL ASSESSED VALUE*	*LAND ASSESSED VALUE*	*STRUCTURE ASSESSED VALUE*	*STRUCTURE VALUE ADDED OR (REMOVED)*	*RENOVATION RATiO*	*EFFECTIVE YEAR BUILT*	*ACTUAL YEAR BUILT*	*INTERIOR AREA*	*LOT SIZE*
0131330040030	1999	01	$ 90,656	$ 47,250	$ 43,406	$ -	.	1954	1947	1,401	6,300
0131330040030	2000	01	$ 97,164	$ 51,975	$ 45,189	$ 240	.	1954	1947	1,401	6,300
0131330040030	2001	01	$ 124,455	$ 51,975	$ 72,480	$ 9,975	0.24	1997	1947	1,732	6,300
0131330040030	2002	01	$ 144,952	$ 51,975	$ 92,977	$ -	.	1997	1947	1,732	6,300
0131330040030	2003	01	$ 159,367	$ 54,495	$ 104,872	$ -	.	1997	1947	1,732	6,300
0131330040030	2004	01	$ 180,641	$ 70,875	$ 109,766	$ -	.	1997	1947	1,732	6,300
0131330040030	2005	01	$ 221,377	$ 102,690	$ 118,687	$ -	.	1997	1947	1,732	6,300

This table provides an example of the panel data approach used to identify renovation properties in this study. The table reports a sub-sample of data fields contained in the original files obtained from the Florida Department of Revenue (some variable names have been changed for tractability). Since each variable is observed for each property in the sample for each year, renovations can be identified directly within the dataset by examining changes in these variables. A brief explanation of some of the variables follows. *STATE LAND USE CODE*: "01" indicates improved single family residential and "00" indicates vacant residential. *STRUCTURE VALUE ADDED OR (REMOVED)*: a positive number indicates the value of new improvements added to the property, while a negative number indicates the value of improvements that were demolished. It should be noted that *RENOVATION RATIO* is a variable created in this study, and is calculated as the sum of all renovation expenses from 1999 to 2004 divided by the structure value in the year prior to the first year of renovation activity.