Finding an Impact of Preservation Policies: Price Effects of Historic Landmarks on Attached Homes in Chicago 1990-1999

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Urban renewal and community development have a close and complex relationship with historic preservation. Historic buildings and neighborhoods often are the focus of redevelopment efforts, either as obstacles or catalysts. On one hand, redevelopment and land-use changes may draw the ire of preservationists by transforming historical structures, landscapes, or the character of a neighborhood. On the other hand, historic landmarks may be exploited as amenities to foster local redevelopment. This article discusses some of the challenges in identifying the effects of historical preservation policies and sheds some light on the effects of landmarks policies in Chicago.

Many urban policy debates feature the historic character of the built environment and the extent to which it is preserved. Some advocates seek to preserve cultural resources, heritage, or identity. These less tangible resources can have substantial value to preservationists and society more broadly (see examples in Navrud & Ready, 2002). Other economic development interests may be more interested in increasing property values, expanding the tax base, and fostering transformations (of the built environment) that bring economic growth to an area. Historic preservation interests may conflict with these economic development interests at times. In other cases, historic preservation can enhance neighborhood quality and property values, thereby serving economic development interests. This argument is offered by “smart growth” advocates and scholars, for instance, who commonly recognize the importance of historic preservation (e.g., International City/County Management Association and the Smart Growth Network, 2003; National Association of Realtors, 2005; Talen, 2002). Community development interests also have a stake in some historic preservation policies, which can affect the supply of affordable housing and even the social fabric of the community. Understanding the actual impacts of historic preservation policies can help guide policymakers in striking a balance between these numerous competing interests.

Numerous policy tools directly affect historic preservation efforts. At the federal level, the National Register of Historic Places boasts over 1 million buildings and sites and adds over 1,000 sites annually (for further discussion of the National Register, see Schuster, 2002; Swaim, 2003). Federal listing is voluntary and carries no restrictions on private property, but it does make rehabilitation of some properties eligible for a 20% investment tax credit. Although federal listing is largely honorific, especially for owner-occupied residences, state and local historic landmark designations may carry considerably more weight. Some local rules include financial assistance for or use restrictions of historic property owners, sometimes using the National Register to identify historic properties. In addition, the National Historic Preservation Act of 1966 made provisions for property owners to receive tax deductions for preservation easements on historic properties.

In the local setting considered in this article, the Commission on Chicago Landmarks has been recommending landmark designation for properties to the City Council since it was established by ordinance in 1968. In the past 35 years, 4,500 properties in 34 historic districts have been so designated. The Commission in the city's Department of Planning and Development must approve alterations or construction that affect landmarks. They also oversee a variety of financial incentive programs for landmark owners. Owner-occupied residences are eligible for a 12-year freeze on property taxes and waivers of building permit fees. Other incentives apply to different landmark property types.

This article contributes to the literature by identifying biases common in previous studies and implementing a method to correct for them. This article offers more empirical evidence on the relationship between prices and historic designation. The methodology employed here allows for more robust interpretation of the effect or impact of landmark designation. Moreover, unlike previous research, the methods used here account for spatial dependence in the data and improve inferences about the statistical significance of implicit prices of landmark characteristics. This approach informs our understanding of the neighborhood effects of historic landmarks.

Background

One rationale for historic preservation policies is that markets fail to optimally provide for preservation (Coulson & Leichenko, 2001; Rypkema, 1994). Individual properties may contribute to the historic character of the urban environment, and this historical externality may affect the well-being of others in ways not captured by prices. The owner of a historic hotel may add to the charm of downtown and certainly to the quality of the view from apartments across the street, yet the owner receives no compensation from those external benefits. Thus, it is argued, policies are needed to preserve those historic characteristics.

In practice, though, historic preservation may represent a very hard case for market failure-motivated policy. Unlike typical land-use spillovers such as smoke or noise, historical character might be construed as cultural or social capital. The possibility that the amount of historical preservation may affect one's value of historical preservation complicates the policy questions of entitlement to unrestricted property use or to neighborhood stability. The irreversibility of alterations to historical character complicates matters still further.

In Chicago, landmarks can be designated for many reasons. The many purposes of the landmarks ordinance include preserving and rehabilitating aspects of the built environment with special significance (Commission on Chicago Landmarks, 2006). It explicitly aims to preserve neighborhood character, promote economic development and an expanded property tax base, prevent urban blight and reverse deterioration, and cultivate civic pride. Potential landmarks are evaluated based on several criteria concerning the historical, architectural, and aesthetic significance to the city.[1] In practice, the landmarks designated in Chicago span the spectrum of eligible properties. Current Chicago landmarks were built between 1803 and 1967 (mean year of 1898). Over one third of them are on one of 13 architectural tours. Out of 230 landmarks, 37 are districts (e.g., Wicker Park, Bronzeville) and 15 are neither buildings nor districts (e.g., Buckingham Fountain, Getty Tomb, Site of the First Self-Sustaining Controlled Nuclear Chain Reaction).[2] Objective measures of their individual significance and rationale for designation are unavailable. Informal inspection of the designated landmarks suggests that some reflect Chicago's cultural heritage (e.g., Old Water Tower District, Union Stockyards Gate, Robie House, Carbon Carbide Building, First Church of Deliverance) more than others (e.g., Schlect House, Henry Gerber House, Wingert House). Each landmark may have been designated to achieve one of more of the ordinance's objectives. Arguably, most of these designations were intended to preserve or enhance neighborhood quality, which could then be reflected in housing prices.

Historic preservation policies can have several effects, and this article focuses its attention on those values expressed through property markets. Restrictions on property use should reduce property values, reflected in lower sale prices. Eligibility for tax deductions and other financial assistance, on the other hand, should increase property values and be reflected in higher sale prices. Landmark designation that confers honorific status may also see that symbolic value captured by higher prices. Preservation policies also provide stability to a neighborhood by limiting change, thereby reducing the investment risk for other property owners. Frequently, observers cite intangible external benefits to historic designation, such as signaling "public commitment" to an area (Schaeffer & Millerick, 1991), solving market failure in "providing a sense of unity with the past" (Asabere & Huffman, 1994b), strengthening the "social fabric" of a community (New York Landmarks Conservancy 1977), and "catalyzing" rehabilitation of nearby areas (Coulson & Leichenko, 2001; Listokin, Listokin, and & Lahr, 1998; Rypkema, 1994).

Previous Findings

Measuring these effects is an empirical matter. The scholarly literature has yielded motley results on the price effects of historical preservation policies. Leichenko, Coulson, and Listokin (2001) review empirical works in this area, showing how the "impact of designation on property values" varies across studies and across empirical methods. Several earlier studies (e.g., Benson & Klein, 1988; Gale, 1991; Scribner, 1976) use a difference-in-difference method to identify price effects of historic designation. This method typically involves comparing sample average property value growth rates in historic and nonhistoric districts. Many other omitted factors that differ between areas may be relevant and better explain differential growth rates. More recent research has employed hedonic pricing method to assess the implicit price of properties' attributes with historic designation being one of those attributes. Examples of this approach (Asabere & Huffman 1994a, 1994b; Clark & Herrin, 1997; Coulson & Leichenko, 2001; Schaeffer & Millerick, 1991) control for many other features of properties yet also find mixed results. Schaeffer and Millerick (1991) claim that some of the variation in price effects is due to differences in landmark regulation at local and national levels. Leichenko et al. (2001) control for different types of historic designation and conclude that it does matter in some areas and that price effects generally vary across cities and sources of data.

With over 2,000 local historic district commissions and thousands of diverse properties listed on the National Register, one might expect local studies to yield divergent results. Leichenko et al. (2001) find historically designated properties in Texas to have 5 to 20% higher appraised prices than other properties. Coulson and Leichenko (2001) find that local "historical designation adds about 17.6% percent to the value of a unit" (p.118) in Abilene, Texas. In Philadelphia, owner-occupied properties located in historic districts listed on the National Register sell at 26% higher prices than other properties sampled by Asabere and Huffman (1994b). Philadelphia condominiums with historic easements, however, sell for about 30% less than comparable properties, and that price is discounted by 4.6% per year after the donation (Asabere & Huffman, 1994a).

The empirical literature has addressed the issue of externalities from historic preservation sparingly to date. It is hypothesized that historic buildings have positive (or negative) effects on neighboring properties' prices. Coulson and Leichenko (2001) seek to estimate the external impact of historic designation, using a hedonic price method that includes the number of historically designated properties in a unit's census tract as an attribute of that unit. They find that each additional historic house in a tract in Abilene, Texas is associated with a sales price that is 0.14% higher.

There may also be public-good benefits from preservation beyond the impact on properties and nearby properties. Several authors have sought to measure those public-good benefits of historic preservation using stated preference techniques such as contingent valuation (see, e.g., Chambers, Chambers, & Whitehead, 1998; Kling, Revier, & Sable, 2004).

There is a temptation to conclude that higher or lower prices associated with historic landmarks are the consequence of their designation. Without a careful research design, however, this conclusion may be unwarranted. Two problems arise: omitted-variable bias and endogenous designation. Historic designation is likely correlated with other (unobserved) characteristics of the property. Higher-quality properties, those maintained better, or those in premium locations may be more likely to become designated.[3]

Coulson and Lahr (2005) acknowledge this potential for omitted-variable bias in examining designation impacts. Their method, examining the difference in appreciation rates between properties in otherwise comparable (historical and non-historical) districts, stands to correct for this. Although they do find substantially higher appreciation rates for properties in locally designated historic districts, their analysis hinges critically on (a) the selection of comparison neighborhoods (done by the Memphis Landmarks Commission using undisclosed methodology), (b) appraisal rather than sales data, and (c) the absence of neighborhood-level or geographic variables common to hedonic models. This article improves on this by looking at designations occurring between sales, using repeat-sales data, and including a broader set of neighborhood and geographic variables.

Second, an endogenous designation process may complicate matters further. Properties in areas ripe for revitalization or in "hot" areas may attract the attention of landowners and local officials who support landmark status. Thus, buildings' and neighborhoods' price levels and trends influence the likelihood of receiving landmark designation. If we think that historic designation is assigned deliberately depending on site characteristics (e.g., price) and expectations about the future (Coulson & Leichenko, 2004), then a selection bias may limit causal interpretations of many earlier findings. Does designating a home as historic cause its price to rise by 18%, or do high-priced (or fast-appreciating) homes become designated? The possibility of and problems arising from endogenous designation remains the subject of future research. For now, this article addresses the omitted-variable problem and robustly controls for the significant influence of unobserved quality on observed price differentials associated with landmarks.

Empirical Method

Hedonic Price Method

Price effects of landmark designation are estimated using hedonic price models. Hedonic price models are based on the theory that houses are goods with many attributes and that the marginal implicit prices for the attributes can be identified by assessing how sale prices vary with attributes. Researchers frequently use hedonic analyses to identify the marginal price of changes in location, environmental quality, and other neighborhood characteristics. See Rosen (1974) and Freeman (2003) for further discussion of the method.

The first-stage of a hedonic analysis identifies implicit attribute prices. The first-stage hedonic regression estimates the following general model:

$$Price_i = f(Attributes_i) + \varepsilon_i \qquad (1)$$

where $Price_i$ is the sale price, $Attributes_i$ is a vector of attributes of a house, and ε_i is an error term, all for the *i*th house. Equation 1 is typically estimated using a regression framework. The estimated coefficients for each attribute indicate the marginal price for that attribute.

Repeat Sales

The data in this study offer an opportunity to use a repeat-sales framework for the hedonic analysis.[4] This approach has an advantage in that it controls for time-invariant unobserved or omitted attributes. Consider a semi-log specification of the hedonic price function for a sale of the *i*th house in period *t*:

$$\ln(Price_{it}) = \alpha_t + \beta Attributes_{it} + \gamma Invariant_i + \delta Landmark_{it} + \varepsilon_{it}\,. \qquad (2)$$

Fixed effects for each time period are captured by α_t. The coefficient β indicates the marginal price (in percentage terms) of the attribute. Also, γ is the marginal price of the $Invariant_i$ variables, representing time-invariant attributes of house *i*. The $Landmark_{it}$ variable is another attribute of house *i* in period *t*, indicating whether the house is designated as a landmark (=1) or not (=0). Thus, δ is the implicit price of landmark status.

Estimating equation 2 may not identify the “effect” of landmark status on price if some attributes (time variant or invariant) are correlated with $Landmark_{it}$ and are omitted.

For instance, if landmarks tend to have high construction quality and this quality is something that garners a higher market price, the omitting measures of construction quality will yield a δ that is biased upwards. Taking the difference of ln($Price_{it}$) and ln($Price_{is}$), for the sale of the same house in periods t and s, yields:

$$\ln(Price_{it}) - \ln(Price_{is}) = \alpha_t + \beta Attributes_{it} + \gamma Invariant_i + \delta Landmark_{it} + \varepsilon_{it} - (\alpha_s + \beta Attributes_{is} + \gamma Invariant_i + \delta Landmark_{is} + \varepsilon_{is})$$

$$\ln(Price_{it}/Price_{is}) = \alpha_t - \alpha_s + \beta(\Delta Attributes_i) + \delta(\Delta Landmark_i) + \varepsilon_{it} - \varepsilon_{is} \,. \qquad (3)$$

As the time-invariant attributes drop out, the change in ln(*Price*) is a function of appreciation, the change in attributes, and the change in landmark status. This construction assumes that the marginal attribute price is constant over time. Equation 3 can be easily adjusted to allow for β to vary over time, however. See Kiel and Zabel (1997) for further discussion of this "hybrid model" and extensions in Clapp and Giaccomotto (1998).

In equation 3, the estimated δ coefficient represents the implicit price associated with a change in landmark status. By estimating equation 3 instead of 2, however, δ is no longer subject to bias from omitting $Invariant_i$ variables, even unobservable ones. This can be especially important for historic landmark properties, where some intangible or unobserved property characteristics may explain its different price rather than its mere formal designation. For example, if landmark properties have higher quality construction, special or unique "historic" design features, or extra prestige associated with them, a hedonic analysis using equation 3 that omits these difficult-to-observe variables (which are constant over time) will not bias its δ estimate. In other words, historic *designation* will not be proxying for all of the underlying features that got the property designated in the first place. It will better capture the before-and-after price effect of designation.

The hybrid repeat-sales model from equation 3 is straightforward to estimate using OLS. Letting D_{it} be dummy variables indicating whether house i was sold in period t, the model to estimate becomes:

$$\Delta\ln(Price_i) = \sum(\alpha_t \Delta D_{it}) + \beta(\Delta Attributes_i) + \delta(\Delta Landmark_{\mathrm{i}}) + \theta_i \; . \qquad (4)$$

The ΔD_{it}, for $t = 1,\ldots,T$, is a set of indicator variables taking a value of 1 in the year of the property's final sale, a value of –1 in the year of its first sale, and a value of zero otherwise. The θ_i error term is estimated using Huber-White robust errors.[5]

Spatial dependence

Before proceeding to estimate the hedonic models, the matter of spatial dependence in the data needs to be addressed. Just as $Price_i$ and $Attribute_i$ are not randomly distributed geographically around the city, neither are the error terms. This can lead to spatial autocorrelation, i.e., where the model's error terms are spatially clustered. This is just one way in which spatial dependence may exist in the data, and it is now often addressed in hedonic research.[6]

A spatial autoregressive (SAR) model can account for spatial structure of the error term. (See Anselin 2001, 2003.) In this regression model, an $N \times N$ weights matrix W is introduced. W describes the "neighborliness" of observations to each other. In matrix form, the vector of errors, θ in model (4), is specified in an SAR model as:

$$\theta = \lambda W\theta + \mu \qquad (5)$$

where μ is an independent and identically distributed vector of error terms. The parameter λ corrects for the spatial correlation in the error. Estimating equation 4 with the spatial autoregressive error via OLS involves a nonspherical error and leaves the coefficients unbiased but the standard errors both biased and inefficient. Accounting for the SAR error structure described in equation 5 can avoid these biases.[7]

For this analysis, the W matrix assigns a value of 1 to neighbors within ¼ mile of the sold property.[8] Otherwise, cells in W take a value of zero. Diagnostic tests for the presence of spatial dependence in the data are conducted as per Anselin, Bera, Florax, and Yoon (1996), clearly indicating spatial autocorrelation in the residuals from estimating equation 4 via OLS.[9]

Data Description

The data for this analysis come from several sources. Landmark information comes from the City of Chicago's Landmarks Division of its Department of Planning and Development (City of Chicago, 2004). For the 193 landmarks and 37 landmark districts in the city (including 4,500 properties) as of July 2003, information on their date of designation, architect, and year of construction is available. Numerous sources contribute to the geographic data. The U.S. Census Bureau's TIGER files (U.S. Census Bureau, 2005) provide most of the maps. These are complemented by a map of Chicago's community areas (Siciliano, 2004). The property and sales data come from the Multiple Listing Service (MLS) records of sales of all "attached" residential property sales in the city of Chicago from 1990 to 1999. These attached properties are typically condominiums and townhouses (in contrast to detached single-family housing, or multi-family housing). There were 73,106 attached residential property sales using the MLS in Chicago during the 1990s, which accounts for a large share of all residential property sales in the city. The MLS records were sufficient to map over 71,275 of these observations, although many of these records are missing valid information. As expected, many of the properties are concentrated downtown, near Lake Michigan, and in other pockets scattered around the city.

Missing information for certain variables in the MLS data set has been dealt with as follows: Two key variables, square footage and year built, are missing from 24,835 and 27,608 observations, respectively. First, the analysis is performed using the subsample of those observations for which no information is missing. This solution discards much information and, to avoid bias, relies on the discarded observations being representative of those remaining. Because of the well-established problems with listwise deletion strategies (see, e.g., Little, 1992; Little & Rubin, 1987), these results appear in the Appendix for comparison. Secondly, a multiple imputation by chained equations (MICE) method is used to impute plausible missing values for area and year built, incorporating some randomness to capture the uncertainty in the imputations (Royston, 2005).[10] By repeating this imputation several times, the resulting data sets are analyzed identically and their estimates pooled to obtain confidence intervals. This method has the advantages of using more information and assuming only that the probability of an observation missing a value does not depend on unobserved information.

Despite the missing information, the MLS data have several desirable features. First, it captures actual sales and perceived attribute values of those involved in the transaction. Actual market data are superior to appraisal data in this regard, although sales data reveal prices only for properties actually sold rather than the universe of properties in a city. A selection bias is thus possible. Second, the MLS data records have information about a wide range of property attributes (e.g., list and sale price and date, dimensions of various rooms, tax payments). Finally, because the sample covers nearly all sales of attached properties during a 10-year span, many properties were sold multiple times during that period. This allows for a repeat-sale approach. Table 1 contains the variable descriptions, and Table 2 presents the sample descriptive statistics.

[Insert Tables 1 + 2 about here]

Empirical Results

The first set of results is presented for the hedonic regression using all sales of attached housing in Chicago during the 1990s. This hedonic model estimates equation 2 for a large set of attributes of the properties and neighborhoods. Over 63,000 observations have complete (or estimated) information for all variables. The results of a Box-Cox regression suggested a semi-log form for the appropriate specification – consistent with recommendations elsewhere in the hedonics literature (Cropper, Deck, & McConnell, 1988).[11] Table 3 shows results for three different models: Model 1 is and OLS model with no community-area effects and no spatial autocorrelation, Model 2 is an OLS model with community effects but no spatial autocorrelation, and Model 3 is a SAR model with no community effects, but it accounts for spatially autocorrelated errors. The community-area effects control for each of 77 community areas' average price levels. Model 1 serves as the baseline for comparison. Both Models 2 and 3 represent improvements in capturing neighborhood effects over Model 1. All test statistics are reported using robust errors. The coefficients estimated using the semi-log models in Table 3 should be interpreted as percentage changes in real sales price for the property, on the margin. Thus, another room or a garage is associated with properties that sell for 3 to 4% more. The estimated spatial nuisance parameter $\lambda = 0.65$ in the SAR model signifies substantial positive spatial autocorrelation.

[Insert Table 3 about here]

The results for each model indicate a good fit to the data. The R^2 of 0.77 for Model 1 rises to 0.79 in Model 2. The estimated coefficients are typically significant at less than the 0.1% level. Each of the coefficients for property attributes and neighborhood characteristics have the expected sign. Bigger units with more rooms sell for higher prices. Prices were also higher for sales downtown and near parks and the river, not too close to Chicago Transit Authority lines and in areas with high property values, low density, fewer nonwhites, higher incomes, and older buildings. One unexpected result is the positive coefficient for *distance to lake*, which indicates that additional distance *away* from Lake Michigan is associated with a *higher* sales price.[12] When community-area effects are controlled for, however, *distance to lake* becomes a disamenity beyond 3.6 km.

The variables of interest in Table 3, the landmark variables, tell an interesting story. Units in properties that are designated landmarks (buildings or districts) sell for a substantial premium over comparable properties (10.6% higher prices). Controlling for community areas, that premium falls to 8.9%. Those properties in landmark districts receive only a 3 to 5% premium. Controlling for community effects or for spatial dependence in the data appears to reduce the landmark premium as well as the difference in premiums between landmark buildings and districts. So far, these results are broadly consistent with much of the previous literature and conventional wisdom.[13]

The hedonic models in Table 3 also account for “neighbor effects” or the sale properties’ proximity to other landmarks. In Model 1, each additional landmark in a block group is associated with 1.9% lower sales prices for attached homes in that block group. This contrasts with Coulson and Leichenko (2001), whose similar approach finds that prices are higher with more landmarks nearby. Controlling for community-area effects (Model 2) or spatial dependence in the data (Model 3), however, accounts for much of this negative effect. The number of landmarks in a block group may proxy for some more general “neighborhood effect” not attributable to landmarks. Overall, the hedonic models in Table 3 show *BG-landmarks* to be neither an amenity nor a disamenity.

Models in Table 3 also control for characteristics of the nearest landmark. The price effect of proximity to landmarks is sensitive to different modeling assumptions about space and neighborhoods. In the models with no community effects, the price effect of distance to the nearest landmark is significantly different from zero. It becomes insignificant after controlling for community areas. Although properties that are closer to landmarks might sell at a premium, that premium increases with the time elapsed since the nearest landmarks construction or designation date. This effect may reflect that recently constructed or designated landmarks are increasingly “marginal.” It might also reflect a tendency for recent landmarks to be designated in neighborhoods with depressed prices.

As noted above, care should be taken before interpreting the results in Table 3 to demonstrate that landmark designation has an “effect” or “impact” on prices. Landmarks in this sample do sell for higher prices, 3 to 11% higher on average. Yet this may be attributable to unobserved characteristics of the property that are correlated with designation, rather than the designation itself. Looking at repeat sales and estimating equation 4 helps control for the bias of time-invariant unobservables. A Heckman selection model is employed to correct for the likelihood that those properties that sold twice differ systematically from those that only sold once. As the error in equation 4 may follow equation 5, an SAR model is also estimated here. The OLS model serves as the baseline for comparison.

Table 4 shows the results of the repeat-sales hedonic framework. For attached homes in Chicago, the MLS data has complete information for 4,150 properties that were sold at least twice during the 1990s. As is common in repeat-sales hedonic regressions, the explanatory power of the models wanes when all of the time invariant attributes of a property (e.g., vintage, location) drop out of equation 4. Nonetheless, Table 4 depicts the results of several repeat-sales models: Model 4 is OLS, Model 5 controls for the selectivity bias, and Model 6 controls for spatial autocorrelation. Results for the year control variables (ΔD_{it}) are omitted from Table 4, but Table A2 in the Appendix reprints the full results for the Heckman selection model.

[Insert Table 4 about here]

The repeat-sales framework offers limited evidence of the impact of Chicago's landmark designation program on the value of attached homes in 1990s. Estimating equation 4 via OLS reveals mixed effects of nearby landmarks.[14] On average, sale prices are 2% higher for each additional landmark designated in the property's block group. The repeat-sales approach also reveals price effects of a property's closest landmark changing. If that new closest landmark is older, then the property's price rises on average.

Moreover, sale prices decline by 3 to 5% for each kilometer closer that the closest landmark becomes. The geography is such that less than half of the properties with changes in *CL-distance* had no change in *BG-landmarks*, and vice versa. The result is a complicated situation consistent with landmark designations raising nearby property values but reducing more distant properties' values if the new landmark is now their closest landmark.

Models 5 and 6 in Table 4 relax some assumptions about the error term yet provide very similar results. Controlling for the selectivity bias (e.g., homes that sold multiple times may be somehow different from other homes) does little to affect the estimated landmark effect. The selection equation uses initial attributes and sale price, as shown in Appendix Table A2. Interestingly, landmark buildings (but not districts) appear more likely to sell twice in the 1990s.[15] The SAR model, which controls for spatially correlated errors, but not the selectivity bias, also finds a 2% increase from designating additional landmarks in the property's block-group. Overall, there is at least some indication that property prices rose in block groups that saw more landmarks designated in them during the 1990s.

Summary and Conclusion

Historic and landmark designation can affect prices of both the designated property and neighboring properties. Much of the writing on historic preservation touts sizable gains to society as well as the property owner. Even in the absence of positive net benefits to the property owner, a sort of "taxation by regulation" approach to historical preservation might be taken. Landmark owners may lose a little property value, it is argued, but preservation is serving the broader public interest. Similar justifications are frequently proffered in environmental preservation (e.g., species, wilderness) debates. Restrictions on property use are justified by the sizeable external benefits of preservation (Coulson & Leichenko, 2001). These externalities accrue from neighborhood stabilization, adding prestige or maintaining the “charm” of a neighborhood, and other alleged positive spillovers. Thus, lower prices for designated landmark may merely be the cost of achieving the external benefits from preservation.[16] Regardless, the price effects of designation are a key aspect of historic landmark policy.

Numerous studies have tried estimating price effects of historical status on the landmarks themselves and sometimes also on nearby properties. Previous studies struggle with methodological problems such as omitted variable bias and spatial dependence in the data. Both of these concerns can arise in simple hedonic models in part because of inadequate measures of neighborhood characteristics. Lacking reliable estimates of price effects, the discussion over policy impacts can generate more heat than light.

The results presented here address some of these problems and contribute new empirical evidence. An extensive MLS data set of attached home sales in the city of Chicago during the 1990s is combined with other geographic and demographic data. The simple hedonic shows, like many previous studies, landmark prices are higher. This premium is smaller if the landmark is a district rather than a building. Yet, these effects may be capturing unobserved characteristics as well. A repeat-sales approach is introduced to reduce the bias although the data limitations prevent identifying the implicit price of designation (for the designated property). The housing market captures designation’s external effects (to other properties) as well, and the evidence here is more compelling. The simple hedonic, once appropriate neighborhood controls are included, provides only weak evidence that proximity to older landmarks is an amenity. The more robust repeat-sales estimator, on the other hand, shows stronger evidence of proximity effects such as a positive price of having more landmarks in the block group. Although these price effects may be an artifact of the sample, they provide some support for the view that landmark designation confers substantial external benefits to other properties.[17]

The hedonic analyses presented here account for spatial dependence in the data. Given the intrinsically spatial nature of landmarks and the spatial clustering in designations, geographic measures like *BG-landmarks* and *district* can be susceptible to spatial correlation problems. Neighbor effects in the attached-housing market in Chicago are strong for price levels (equation 2). First-differencing can reduce some of this (time-invariant) interdependence, yet some remains. The effect of spatial interdependence is of particular interest for landmarks, which are often touted as having powerful effects on neighborhood identity, character, and social fabric (Coulson & Leichenko, 2001; Rypkema 1994). Prices tend to rise as more landmarks are designated nearby, yet this may represent the nonrandom designation process (e.g., designation may be drawn to booming neighborhoods, perhaps to slow development or because residents are more able to obtain designation).

Several important limitations apply to these findings. First, these findings apply to a large sample of condo and townhouse sales in Chicago during the 1990s. They may not generalize to other property types, other regions, or other periods. Extending this approach to other property types is obviously a pressing matter for future research. Second, the repeat-sales hedonic framework here assumes constant marginal prices over time. Third, no effort is made here to model the designation of landmark status. Although this article offers more robust procedures for estimating implicit prices, the endogeneity of designation remains the biggest obstacle to assessing the causal effects of historic preservation policies. Designation is unlikely to be independent of property and neighborhood attributes, both observed and unobserved. This selection effect in the treatment of conferring landmark status makes it difficult to draw inferences about the causal role of landmark preservation policies. Even if prices changed following designation, careful research design will be needed to ascertain whether the designation followed price shocks or vice versa.

Conclusive evidence of the price effects of historic preservation programs is elusive, even for a single market. Properties in landmark buildings and districts in Chicago clearly sell for higher prices than other properties. Yet, we cannot distinguish these effects from other unobservable traits of the property that are correlated with designation status. Very little attention has been paid to controlling for these unobserved quality characteristics, a shortcoming addressed by the repeat-sales approach of this article. Doing so demonstrates the significantly higher prices associated with having more old landmarks nearby. It also highlights the limitations of making causal inferences about housing preservation policies without a better understanding of designation processes.

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Appendix

Table A1: Hedonic models, with complete cases only

	OLS, no community		OLS, with community		SAR, no community[a]	
Variables	Coeff.	t-stat	Coeff.	t-stat	Coeff.	z-stat
Constant	-789.417	-0.84	1204.829	1.30	-246.540***	-13.33
Log-area	0.537***	15.30	0.531***	15.32	0.492***	96.38
Year built	0.001***	11.90	0.001***	13.84	0.001***	12.79
Unitbldg	-3.8E-05***	-2.95	-4.9E-05***	-3.82	-5.5E-06	-0.60
Unitbldg^2	7.3E-09***	3.17	7.3E-09***	3.51	8.9E-10	0.37
Rooms	0.017***	4.63	0.017***	4.74	0.016***	14.39
Bedrooms	0.112***	11.49	0.115***	11.98	0.121***	39.77
Baths	0.167***	18.88	0.167***	19.27	0.173***	47.51
Master bath	0.063***	14.57	0.064***	15.45	0.057***	15.96
Fireplaces	0.043***	9.61	0.041***	9.11	0.052***	15.03
Garage	-0.005	-1.17	-0.008*	-1.83	0.024***	5.77
Parking spot	-0.038***	-7.61	-0.041***	-8.55	-0.006	-1.20
Waterfront	0.023***	3.69	0.026***	4.22	0.038***	6.47
Distance to CBD	-0.083***	-18.10	-0.028***	-5.26	-0.038***	-8.05
Distance to CBD^2	0.001***	13.16	0.004***	13.92	0.001***	4.43
Distance to lake	0.026***	8.48	0.014***	2.80	-0.001	-0.31
Distance to lake^2	0.0001	0.29	-0.003***	-4.38	0.001*	1.78
Distance to water	0.038***	4.54	0.040***	2.95	0.046***	4.64

Distance to water^2	-0.012***	-4.73	-0.016***	-3.13	-0.011***	-6.11
Distance to CTA	0.094***	15.31	0.073***	8.81	0.054***	5.50
Distance to CTA^2	-0.009***	-5.58	-0.016***	-4.83	0.001	0.62
Distance to park	-0.046***	-2.75	-0.214***	-11.84	-0.114***	-5.03
Distance to park^2	0.061***	4.34	0.208***	13.72	0.085***	4.02
Northside	69.095*	1.86	767.235***	7.60	388.745***	11.35
Latitude	1.942***	4.14	7.373***	3.31	-9.279***	-11.35
Northside× latitude	-1.647*	-1.85	-18.317***	-7.59	5.650***	12.80
BG-income	0.001***	10.64	0.001***	9.55	0.002***	12.33
BG-value	2.6E-05***	2.75	1.4E-05	1.49	4.3E-05***	4.29
BG-density	-0.001***	-7.78	-0.001***	-8.32	-0.0002	-1.51
BG-nonwhite	-0.236***	-22.10	-0.057***	-4.38	-0.064***	-4.41
BG-year built	-0.002***	-12.98	-0.003***	-19.53	-0.002***	-10.70
BG-landmarks	-0.007***	-3.28	0.005**	2.02	0.008***	3.39
District	-0.225***	-6.69	-0.216***	-6.09	-0.305***	-11.16
Landmark	0.235***	7.17	0.244***	7.07	0.320***	12.13
CL-year built	0.0001	1.04	-0.0001	-1.53	-0.001***	-6.21
CL-date designated	-1.3E-05***	-21.35	-7.3E-06***	-11.84	-5.1E-06***	-6.88
CL-distance	0.001	0.31	-0.004	-0.65	-0.025***	-4.66
Year	0.682	0.72	-1.541*	-1.67	-0.007***	-13.06
Year^2	-0.0002	-0.68	0.0004*	1.71	9.0E-06***	44.78

Community areas	*Omitted*	*Included*	*Omitted*
N =	42394	42394	42394
R^2 =	0.795	0.815	0.753

NOTE: BG = Block group, CL = Closest landmark, CBD = Central business district, CTA = Chicago Transit Authority.

[a] Contiguity defined as all observations within ¼ mile, or approx. 2 city blocks. Spatial nuisance parameter estimated as $\lambda = 0.648$.

* significant at 10%, ** significant at 5%, *** significant at 1% level.

Appendix

Table A2: Full Heckman (Two-Stage) Model for Repeat Sales

	log($Price_0$/$Price_1$)				
	Regression			Selection Equation	
Variables	Coeff.	t-stat	Variables	Coeff.	z-stat
Constant	0.090***	4.75	Constant	53.937	0.27
Differences in:			Log-price	-0.071***	-2.55
Unitbldg	-3.4E-05	-0.72	Year built	-0.0001	-0.23
Rooms	0.003	1.39	Log-area	0.008	0.27
Bedrooms	0.014*	1.75	Unitbldg	-3.8E-05	-0.54
Baths	0.042**	2.17	$Unitbldg^2$	-1.7E-08	-0.59
Master bath	0.017**	2.30	Rooms	-0.020*	-1.94
Fireplaces	0.019**	2.53	Bedrooms	-0.024	-1.14
Garage	0.025***	2.99	Baths	0.005	0.22
Parking spot	0.019***	2.84	Master bath	0.076***	3.38
BG-income	-0.338***	-4.67	Fireplaces	0.129***	6.54
BG-value	3.5E-06	1.55	Garage	1.774***	33.65
BG-density	2.9E-08	0.60	Garage×parking spot	-1.863***	-33.96
BG-nonwhite	-4.3E-06***	-9.26	Parking spot	1.926***	37.24
BG-landmarks	0.017**	2.29	Waterfront	0.037	1.09
CL-year built	-0.001**	-2.24	Distance to CBD	-0.038***	-7.39
CL-distance	0.033**	2.07	Distance to lake	-0.027	-0.91

Years btwn sales	0.043***	8.58	Distance to water	0.008	0.53
D_{ij} vector:			Distance to CTA	-0.010	-0.48
Year=1990	-0.128***	-4.53	Distance to park	0.142***	4.26
Year=1991	0.056**	2.27	Northside	0.175***	3.09
Year=1992	0.056**	2.26	Latitude	0.049	0.04
Year=1993	0.039**	2.00	Longitude	-4.352	-1.53
Year=1994	0.065***	3.66	BG-income	-0.0005	-0.76
Year=1995	0.017	1.13	BG-value	-0.0001***	-3.02
Year=1996	-0.011	-0.83	BG-density	-0.0001	-0.14
Year=1997	-0.025*	-1.94	BG-nonwhite	-0.245***	-4.26
Year=1998	0.008	0.56	BG-year built	-0.002***	-2.66
Year=1999	0.080***	4.74	BG-landmarks	-0.011	-0.94
Inverse Mills ratio	-0.021**	-2.01	District	-0.313**	-2.13
			Landmark	0.255*	1.82
			CL-year built	-0.0001	-0.33
			CL-date designated	2.2E-06	0.62
			CL-distance	0.002	0.13
			Year	-0.217***	-28.83
N =	4150		N =	59044	

NOTE: BG = Block group, CL = Closest landmark, CBD = Central business district, CTA = Chicago Transit Authority.

* significant at 10%, ** significant at 5%, *** significant at 1% level.

Notes

[1] The seven criteria for evaluating a landmark are whether it is identified with a critical part of city's heritage, significant historic event, significant person, important architecture, important architect, distinctive theme as a district, unique visual feature.

[2] The landmarks commission associates each landmark with 1 or more of 21 thematic tours; only 11 landmarks are associated with no themes. The percentage of landmarks falling into these categories are: Pre-Fire Chicago (9%), Great Interiors (15%), Churches and Synagogues (7%), Modern and Post WWII (5%), Early Skyscrapers (10%), Subdivisions/Planned Towns (4%), Labor/Industry (7%), Railroads and Bridges (3%), Prairie School (13%), Parks (3%), Education (3%), Boul Mich (9%), Music and Art (12%), African-American History (4%), Art Deco (8%), Terra Cotta (13%), Innovative Housing (6%), Mansions (12%), The Loop (19%), Districts (16%), Abraham Lincoln and the Civil War (2%).

[3] In these cases, designation "follows the market" (Schaeffer & Millerick, 1991).

[4] Such an approach might be thought of as similar to the difference-in-difference approach previously employed in comparing changes in average sales prices across neighborhoods, except now we can compare changes in actual sales prices for the same properties.

[5] Note, however, equation 3 contains $\varepsilon_{it} - \varepsilon_{is}$, which may not be zero in expectation if equation 2 is based on the full sample of all sales (includes repeat and single sales). To account for this, θ_i is replaced with an estimate of the inverse Mills ratio (from a probit of whether a sale was a repeat sale or not). Controlling for this selectivity bias does not appear to have substantial effects on the results of interest to this paper. Nonetheless,

these results are presented in Table 4 and Table A2.

[6] Another form of spatial dependence, often called a “spatial lag,” posits that the dependent variable is endogenous or that sale prices of neighbors affect each other. This sort of contagion effect has been observed in residential property sales (e.g., Ioannides, 2003) and can also be modeled. But this approach is beyond the scope of this paper.

[7] Alternative spatial error models are available, of course. For example, Pace, Barry, Clapp, and Rodriguez (1998) and Gelfand, Ecker, Knight, and Sirmans (2004) present explicitly spatiotemporal SAR models. For simplicity, the repeat-sales model estimated here takes a reduced-form approach. The error resulting from Equation 2 takes the form of θ in Equation 5, as does the error resulting from Equation 4. This can be interpreted as the spatial nuisance operating for both price levels and price changes, although the spatial process or nuisance (λ) need not be the same.

[8] Common weights matrices use adjacency or inverse of distance between observations to define neighbors. Given the nature of the data (i.e., each observation is a condo or townhouse, and many are geographically “stacked”), a spatial weight matrix based on distance bands is used. Here, all observations that are within a ¼ mile (corresponding to 2 city blocks in Chicago) to the observation in question are treated as neighbors, and the remainder are not. Alternative constructions of W were tested here. Constructions of W based on a ¼-mile band provided the best fit. Given the size of the data set, computational limits narrowed the range of W’s tested. Results do not differ substantively across these alternative weights matrices.

[9] Different ways to estimate this model include maximum likelihood (ML) and generalized method of moments (GMM). This analysis uses the SpaceStat (Anselin,

1995) software program to estimate the spatial models. Due to computational limits and the large sample size (N ≈ 63,000), this study opts for the GMM approach. The estimation technique uses λ to find consistent estimates of β and δ but cannot make inferences about the presence of spatial dependence.

[10] The imputation of "area" and "year built" relied on the other variables listed in Table 1 as well as values for: story number of unit; community area indicator; presence of a basement; presence of a basement bath; and areas of living room, kitchen, bedrooms, and dining room.

[11] The Box-Cox transformation yielded a $\theta = 0.065$.

[12] In Model 1 and Model 3, lake proximity is a disamenity after controlling for the following amenities: being on the waterfront, being near lakefront parks, being near downtown, and being near any body of water. In light of these controls, the omission of community effects and variables directly measuring access to transportation, and the "attached homes" nature of the sample, this result may not be too surprising.

[13] Table A1 in the Appendix presents results without imputing missing values for *year built* and *log-area*. Relative to Table 3, the effects of *landmark* and *district* in Table A1 have similar signs but are several times larger. The effect of landmark districts, found by summing the coefficients for *district* and *landmark*, is actually smaller without imputed values. Properties in districts receive a significant premium (2.9%) only when community area effects are included. Although districts have minimal effects on prices in Table A1, landmark buildings receive a 24 to 32% premium depending on the model. This larger premium can be accounted for in the nonrandom nature of the missing data. In this MLS data set, more expensive properties in landmark buildings are much less likely to be

missing key data than other landmark properties. Thus, the *landmark* coefficient in Table A1 is likely biased upwards as less-expensive landmarks are excluded.

[14] Unfortunately, even in a city as large as Chicago with an extensive and vibrant historic landmarks program, only 18 attached homes were sold before *and* after a landmark designation during the 1990s. The effect on its own price of designating a property as a landmark cannot be identified in a repeat-sales hedonic using these data. The spillover effects on neighboring properties, on the other hand, can be.

[15] The probit in the first stage indicates that many attributes of a property predict whether it will have multiple sales. Interestingly, proximity to and characteristics of the nearest landmark appear unrelated to the probability of being a repeat-sale property. If historic preservation stabilizes neighborhoods, it does not appear to affect the frequency of transactions for nearby properties in this sample.

[16] In his guide for preservation advocates, Rypkema (1994) asserts "the idea that historic districts reduce property values is blatantly untrue" (p.45). Although conceding that a district may diminish a single property's value, he claims that the sum of property values will increase due to interdependencies. He also claims "not a single credible study has demonstrated that historic districts reduce property values" (p.46). Notwithstanding Schaeffer and Millerick (1991) and the evidence cited in Leichenko, Coulson, and Listokin (2001), this paper casts doubt on Rypkema's assertions by finding some adverse effects of nearby and new landmarks.

[17] There may be sizable external benefits not captured by properties, e.g., public goods values. These were found in studies like Kling, Revier, and Sable (2004) and Chambers, Chambers, and Whitehead (1998).

Table 1

Definitions of Variables Used

Variable	Definition
Log-price	ln (real sales price, adjusted to 1 January 2000 $ using Chicago's housing Consumer Price Index deflator)
Log-area	ln (area of unit in feet^2). Imputed via MICE.
Year built	Year unit built. Imputed via MICE.
Unitbldg	Number of units in the building
Rooms	Number of rooms in unit
Bedrooms	Number of bedrooms
Baths	Number of baths
Master bath	Master bathroom dummy
Fireplaces	Number of fireplaces
Garage	Garage dummy
Parking spot	Parking spot dummy
Waterfront	Waterfront dummy
Distance to CBD	Distance to State and Monroe downtown (km)
Distance to lake	Distance to Lake Michigan (km)
Distance to water	Distance to nearest river or lake (km)
Distance to CTA	Distance to nearest CTA rail line (km)
Distance to park	Distance to nearest park (km)
Northside	Northern half of the city dummy
Latitude	Decimal degrees north

BG-income	Median household income (in $1000s), block-group, estimated[a]
BG-value	Median house value (in $1000s), block-group, estimated[a]
BG-density	Population density (1000s/km^2), block-group, estimated[a]
BG-nonwhite	Percentage non-white, block-group, estimated[a]
BG-year built	Median year built for residences, block-group, estimated[a]
BG-landmarks	Number of landmarks in the block-group at time of sale
District	Property is inside a landmark district dummy
Landmark	Property is designated a landmark (includes properties in districts) dummy
CL-year built	Year built of closest landmark
CL-date designated	Date (in days) of designation of closest landmark
CL-distance	Distance to closest landmark (km)
Year	Year of sale

[a] These block-group characteristics were estimated for the sale year using a linear interpolation of the 1990 and 2000 Census estimates for each block group.

NOTE: MICE imputation uses other variables listed in this table and values for: story number of unit; community area indicator; presence of a basement; presence of a basement bath; and areas of living room, kitchen, bedrooms, and dining room.

BG = Block group, CL = Closest landmark, CBD = Central business district, CTA = Chicago Transit Authority.

Table 2

Descriptive Statistics

Variable	N	mean	standard deviation
Real price	63219	$ 181,570.30	158456.30
Log-price	63219	11.88	0.66
Log-area	63219	7.11	0.45
Year built	63219	1960.46	30.73
Unitbldg	63219	143.37	229.37
Rooms	63219	4.76	1.68
Bedrooms	63219	1.87	0.79
Baths	63219	1.54	0.65
Master bath	63219	0.48	0.50
Fireplaces	63219	0.31	0.52
Garage	63219	0.36	0.48
Parking spot	63219	0.18	0.39
Waterfront	63219	0.07	0.25
Distance to CBD	63219	7.33	5.42
Distance to lake	63219	2.27	3.71
Distance to water	63219	0.91	0.85
Distance to CTA	63219	0.76	0.78
Distance to park	63219	0.42	0.33
Northside	63219	0.91	0.29
Latitude	63219	41.93	0.05

BG-income	63219	48.33	22.37
BG-value	63219	308.85	221.19
BG-density	63219	35.40	23.46
BG-nonwhite	63219	0.34	0.25
BG-year built	63219	1954.72	13.23
BG-landmarks	63219	0.57	0.92
District	63219	0.04	0.18
Landmark	63219	0.04	0.19
CL-year built	63219	1891.72	24.00
CL-date designated	63219	8769.28	2809.73
CL-distance	63219	0.74	1.04
Year	63219	1995.55	2.76

NOTE: BG = Block group, CL = Closest landmark, CBD = Central business district, CTA = Chicago Transit Authority.

Table 3

Hedonic Regressions for All Attached Home Sales: Chicago, 1990-1999

	Model 1: OLS		Model 2: OLS		Model 3: SAR[a]	
Variables	Coeff.	t-stat	Coeff.	t-stat	Coeff.	z-stat
Constant	2516.004***	2.86	4466.673***	5.26	-32.884***	-3.05
Log-area	0.186***	25.52	0.187***	25.52	0.322***	72.28
Year built	0.0002***	4.32	0.0003***	5.30	0.001***	10.45
Unitbldg	0.0001***	-9.72	-0.0001***	-10.18	-0.0001***	-7.16
Unitbldg^2	1.9E-08***	6.46	1.8E-08***	6.91	9.7E-09***	4.25
Rooms	0.037***	6.29	0.037***	6.24	0.029***	28.98
Bedrooms	0.148***	8.90	0.153***	8.73	0.117***	47.67
Baths	0.257***	26.85	0.254***	25.32	0.215***	66.94
Master bath	0.089***	24.66	0.089***	25.46	0.063***	19.73
Fireplaces	0.088***	24.06	0.077***	20.93	0.074***	24.52
Garage	0.037***	9.63	0.033***	8.66	0.044***	12.33
Parking spot	-0.025***	-5.85	-0.025***	-6.08	0.002	0.65
Waterfront	0.026***	4.44	0.034***	5.72	0.046***	8.47
Distance to CBD	-0.089***	-25.54	-0.035***	-6.66	-0.081***	-24.81
Distance to CBD^2	0.001***	18.56	0.004***	14.94	0.001***	12.46
Distance to Lake	0.032***	14.68	0.027***	7.05	0.037***	12.60
Distance to Lake^2	-0.0002*	-1.72	-0.004***	-11.35	-0.0004**	-2.46
Distance to water	-0.008	-1.58	0.010	1.05	-0.011*	-1.72
Distance to water^2	-0.004***	-4.10	-0.010***	-3.23	-0.007***	-7.80

Distance to CTA	0.060***	13.04	0.062***	9.02	0.021***	3.42
Distance to CTA^2	-0.005***	-6.94	-0.013***	-5.81	0.001	1.02
Distance to park	-0.057***	-3.82	-0.153***	-9.48	-0.084***	-4.55
Distance to park^2	0.107***	8.29	0.180***	13.20	0.101***	6.07
Northside	40.221	1.55	560.010***	10.24	-4.119	-0.19
Latitude	1.486***	4.80	3.446***	3.12	0.102	0.20
Northside× latitude	-0.957	-1.55	-13.368***	-10.24	0.597**	2.33
BG-income	0.001***	9.11	0.001***	7.55	0.001***	11.14
BG-value	3.7E-05***	4.42	1.2E-05	1.35	7.3E-05***	8.06
BG-density	-0.001***	-16.07	-0.001***	-16.37	-0.0003***	-3.76
BG-nonwhite	-0.295***	-32.28	-0.093***	-7.91	-0.231***	-20.51
BG-year built	-0.002***	-13.89	-0.003***	-19.69	-0.002***	-12.23
BG-landmarks	-0.019***	-9.92	-0.003	-1.48	-0.002	-0.72
District	-0.077***	-2.82	-0.039	-1.33	-0.028	-1.35
Landmark	0.106***	4.09	0.089***	3.13	0.065***	3.16
CL-year built	1.4E-05	0.22	-0.0002***	-3.16	-0.001***	-7.77
CL-date designated	-1.2E-05***	-21.74	-7.0E-06***	-12.05	-5.2E-06***	-8.19
CL-distance	-0.017***	-7.19	-0.006	-1.25	-0.011***	-3.71
Year	-2.605***	-2.96	-4.639***	-5.47	-0.007***	-15.94
Year^2	0.001***	3.00	0.001***	5.51	8.9E-06***	50.88
Community areas	*Omitted*		*Included*		*Omitted*	

N =	63219	63219	63219
R^2 =	0.765	0.787	0.734

NOTE: BG = Block group, CL = Closest landmark, CBD = Central business district, CTA = Chicago Transit Authority.

[a] Contiguity defined as all observations within ¼ mile, or approx. 2 city blocks. Spatial nuisance parameter estimated as $\lambda = 0.648$.

* significant at 10%, ** significant at 5%, *** significant at 1% level.

Table 4

Repeat-Sales Hedonic Models

Variables	Model 4: OLS Coeff.	t-stat	Model 5: Heckman[a] Coeff.	z-stat	Model 6: SAR[b] Coeff.	z-stat
Constant	0.051***	9.29	0.090***	4.75	0.050***	8.07
Differences in:						
Unitbldg	-3.4E-05	-0.71	-3.4E-05	-0.72	-3.3E-05	-1.01
Rooms	0.004	1.47	0.003	1.39	0.005**	2.47
Bedrooms	0.015*	1.78	0.014*	1.75	0.014***	2.80
Baths	0.042**	2.17	0.042**	2.17	0.041***	3.47
Master bath	0.016**	2.25	0.017**	2.30	0.012*	1.96
Fireplaces	0.018**	2.39	0.019**	2.53	0.022***	3.00
Garage	0.024***	2.89	0.025***	2.99	0.021***	2.82
Parking spot	0.016**	2.55	0.019***	2.84	0.018***	2.99
BG-income	-0.364***	-5.10	-0.338***	-4.67	-0.363***	-4.68
BG-value	3.63E-06	1.63	3.45E-06	1.55	3.2E-06	1.55
BG-density	3.75E-08	0.77	2.9E-08	0.60	-9.5E-10	-0.02
BG-nonwhite	-4.1E-06***	-9.11	-4.25E-06***	-9.26	-3.3E-06***	-6.17
BG-landmarks	0.018**	2.37	0.017**	2.29	0.020**	2.35
CL-year built	-0.001**	-2.31	-0.001**	-2.24	-0.001**	-2.13
CL-distance	0.034**	2.11	0.033**	2.07	0.047***	2.91
Years btwn sales	0.045***	8.95	0.043***	8.58	0.042***	9.60

Year indicators	*Included*		*Included*		*Included*	
Inverse Mills ratio			-0.021**	-2.01		
	N=4150	R^2=0.20	N=4150		N=4150	R^2=0.19

NOTE: BG = Block group, CL = Closest landmark.

[a] Heckman model estimated via two-step procedure using MICE methods (because the selection equation includes the imputed *year built* and *log-area*). A Heckman selection model with listwise deletion yields comparable results.

[b] Contiguity defined as all observations within ¼ mile, or approximately 2 city blocks. Spatial nuisance parameter estimated as $\lambda = 0.376$. Moran's $I = 0.085$*** (Moran, 1950). Robust LM(error) = 35.05 (p-value < 0.0001).

* significant at 10%, ** significant at 5%, *** significant at 1% level.