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Property values on the plains: the impact of historic preservation

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Abstract We provide an estimate of the impact of historic designation on the sale price of single-family homes in Lincoln, Nebraska neighborhoods. We contribute to the literature by measuring the impact of historic designation using sale prices rather than assessed values, and by utilizing time series, cross-section data with both pre-designation and post-designation observations. The entire sample is used to estimate a difference-in-difference model which shows that historic designation yields a $5,000 increase in the value of single-family homes in the period after designation. A sub-sample of houses with repeat sales is used to estimate a repeat sales model, which shows that designation does not impact appreciation rates.

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1 Introduction

Many cities have designated neighborhoods as historic to accomplish policy goals such as preserving a neighborhood's character, urban revitalization and protection of property values. We focus on the impact that designation has on the latter issue of

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property values by looking at a set of neighborhoods in Lincoln, NE. We contribute to the literature on historic designation and property values by examining the impact of historic designation on sale prices, and by utilizing time-series, cross-section data on sale prices containing both pre-designation and post-designation observations in order to estimate a difference-in-difference model.

Such analysis is particularly important for the case of historic designation, since its impact on property values is largely an empirical question. There are reasons to expect that designation may either increase or decrease property values. Designation acts as a form of insurance of future neighborhood quality, raising property values. It can have positive spillovers to neighboring areas. Designation may also bring a cachet that enhances property values. On other hand, designation may reduce property values as well. Restrictions on alterations and demolition may make potential buyers less likely to buy designated properties. Designation may require costly maintenance and facades, or it may either prohibit or restrict conversion. Hence, designation's impact on property values is not known, a priori.

To examine the impact of historic designation on property values, we gather data on the sale prices of properties in nine historic designated and nine control neighborhoods in Lincoln, NE, for the years 1990 through 2007. We also collect hedonic measures of housing stock and neighborhood characteristics for properties located in all neighborhoods that received historic designation, and for properties located in the matching control neighborhoods that have not received historic designation. We develop a difference-in-difference model of sale prices both before and after historic designation to explore how the act of designation itself as well as unobserved neighborhood effects influence sale prices.

Consistent with previous research using cross-section data (Ford 1989; Asabere and Huffman 1994a; Clark and Herrin 1997; Leichenko et al. 2001), our estimates using a difference-in-difference model suggest a positive and statistically significant relationship between historic designation and neighborhood sale prices. The sale prices of homes in designated neighborhoods rise on average by $5,000 compared to control neighborhoods in the years after historic designation.

In all of the analyses, the housing stock characteristics generally have their expected impacts. Additional bathrooms (whether two or three fixture) increase sale prices. Sale prices increase with the number of stalls in a garage, if present. Newer, larger homes tend to have higher sale prices, all else equal, than smaller, older homes. Homes in good condition are worth more than homes in need of repair.

Neighborhood characteristics produce interesting results as well. All else equal, prices are directly related to the percentage of white and Asian households in a neighborhood and inversely related to the percentage of black households. Prices move inversely with the percentage of households over 65 and are directly related to the percentage of housing units that are owner occupied.

Approximately 40% of the homes in our sample sold more than once during the 1990–2007 period. We also use this subsample to examine the impact of designation on appreciation rates. Using this repeat sales model, we do not find that neighborhood designation increases the appreciation of sale prices.

The next section of this paper contains a review of the literature relating designation to value. Section 3 describes the model used in the analysis. The data are described

in Sect. 4. This is followed by an analysis of the hedonic results in Sect. 5 and the appreciation rate results in Sect. 6. This is followed by Sect. 7.

2 Literature review

Several studies have examined the impact of historic designation on property values. Recent analyses employed hedonic methods that regress some measure of value in the post-designation period on a variety of housing characteristics including whether the property is designated as historic. A number of these studies concluded that designated properties and properties located within historic districts typically sold for a premium when compared with similar, non-designated properties. Ford (1989), Asabere and Huffman (1994a), Clark and Herrin (1997), Leichenko et al. (2001), and Coulson and Lahr (2005) all found that designation had a positive impact on property values. Coulson and Lahr (2005) and Clark and Herrin (1997) found that the impact of age on property values varied between designated and non-designated areas. Other hedonic studies, however, such as Schaeffer and Millerick (1991), Asabere and Huffman (1994b), and Asabere et al. (1994), found mixed or negative results.

Studies have also looked more closely at other value-related issues associated with historic designation. Asabere et al. (1994) and Asabere and Huffman (1994b) found that historic designation adversely affected values for multi-unit properties. With respect to neighborhood effects, Coulson and Leichenko (2001) found strong positive price effects from increasing the proportion of historic properties in the same census tract. This was true for both designated and non-designated properties. Clark and Herrin (1997) found no such "neighborhood" effects for homes in adjacent districts. Coulson and Lahr (2005) found that both new and old properties benefit when an entire neighborhood is designated as historic.

The type of designation seemed to play a role in value as well. Neighborhoods can be designated as historic both at the national and local level, with local designation generally resulting in greater restrictions on property owners.[1] Schaeffer and Millerick (1991) found that while national designation enhanced property value, local

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[1] There are two basic types of historic designation. Designation on the National Register of Historic Places is administered by the National Park Service and is the "honor roll" of properties throughout America. Either individual properties or districts can be listed on the National Register, which is more honorary than regulatory. It does not restrict private owners from changing or even demolishing their properties, but it does cause additional reviews, sometimes quite lengthy, of any actions affecting those properties that are federally funded or approved. Properties can also be locally designated. In Lincoln, NE, entire districts as well as individual properties can be designated as Lincoln Landmarks under chapter 27.57 of the Lincoln zoning code. Unlike National Register listing, designation as a Lincoln Landmark provides a degree of protection for (and restriction upon) individual property owners. When the City Council approves a Landmark, it also approves a set of preservation guidelines for exterior changes to the landmark. Before an owner can change their property, their plans must be reviewed in light of those guidelines, especially if a building permit is required. Two other local historic designations apply in special cases. The Nebraska State Capitol and Fairview William Jennings Bryan's home are National Historic Landmarks. This is an elite list of the most important historic places in America. In Lancaster County outside Lincoln's zoning jurisdiction, the zoning codes do not provide a detailed procedure for designating landmarks, but the County Board has the authority to identify historic places by resolution, and has done so in a few cases. None of those places are included in this analysis.

designation had a negative impact. In a separate study, Coulson and Leichenko (2001) also found that national designation increased property value. In contrast, Coulson and Lahr (2005) found that local designation was a more important determinant of appreciation rates than national designation.

Other studies examined the impact of designation on neighborhood demographics. Coulson and Leichenko (2004), for example, looked at the impact that designation had on neighborhood change in Fort Worth. They found that designated neighborhoods "started out with slightly worse neighborhood indicators" but that designation did not lead to gentrification.

3 Explaining prices

We use a difference-in-difference hedonic price model to explore the impact of historic designation on sale prices of single-family houses. Controlling for a variety of characteristics, it tests whether sale prices are higher for designated than non-designated properties. Sale prices, housing characteristics, and neighborhood characteristics are gathered for single family dwellings in nine neighborhoods in Lincoln, NE that have received either local or national historic designations. As in Card and Krueger (1994), the same variables are also gathered for observations in relevant control regions, in this case dwellings in nine matching non-designated control neighborhoods in Lincoln, NE. Equation (1) can be used to model the sale price of property i in year t as:

$$V_{it} = a_0 + a_1 t + a_2 \underline{X}_{it} + a_3 H_i + a_4 D_t + a_5 H_i * D_t + \varepsilon_{it} \tag{1}$$

where V_{it} is the sales price, $\underline{X}_{it}$ is a vector of hedonic attributes for that property (both housing characteristics and neighborhood characteristics), and the ε_{it} are assumed to be distributed iid. The term t indicates a time variable to capture the increase in sale values over time. The dummy variable H_i is assigned a value of 1 if the sold property is located in a neighborhood that is ultimately designated historic and a value of 0 if the sold property is in a control neighborhood. The dummy variable D_t is assigned a value of 1 if a property is sold in an historic neighborhood or in its control in the period after the neighborhood is declared historic and assigned a value of 0 if sold earlier. The coefficient a_5 on the term $H_i * D_t$ is the difference-in-difference operator since it takes a value of 1 if a property is sold in an historic designated neighborhood in the period after designation and 0 if not. This coefficient shows the impact of historic designation on sale values in historic neighborhoods.

The time series nature of our data allows examination of pricing for houses that were sold more than once during the sample period. Repeat sales constitute a subsample of the larger dataset on all houses sold. These repeat sales estimates would account for unobserved characteristics of individual properties as well as unobserved neighborhood characteristics. Therefore, we develop a repeat sales model of sale price appreciation, in order to compare the results of our difference-in-difference model with a repeat sale model.

Using a model similar to Coulson and Lahr (2005) we start with log values for prices in Eq. (1). For a property that initially sells in year t and then sells again in year

$t + \tau$, we can specify the log of the change in value as:

$$\mathrm{Ln}(V_{i(t+\tau)}/V_{it}) = a_1\tau + a_2[\underline{X}_{i(t+\tau)} - \underline{X}_{it}] + [a_4 + a_5 H_i][D_{(t+\tau)} - D_t] \quad (2)$$

The left hand side of Eq. (2) is the appreciation rate between period t and period $t + \tau$. In Eq. (2), the term $[\underline{X}_{i(t+\tau)} - \underline{X}_{it}]$ represents changes in the hedonic measures. Since we measure housing stock and neighborhood characteristics at one point in time for each property, this term drops out of the change in value equation and we are left with three explanatory influences: the time between sales (τ); the impact of designation in both a designated neighborhood and its control ($a_4[D_{(t+\tau)} - D_t]$); and the incremental impact of designation on properties in the designated neighborhood alone ($a_5 H_i[D_{(t+\tau)} - D_t]$).

We can also use a variant of the Weighted Repeat Sales (WRS) Index to examine the impact of designation on appreciation rates.[2] Starting with Eq. (2), if C_t is the log of the city-wide level of housing prices at time t, the Eq. (2) becomes:

$$\mathrm{Ln}(V_{i(t+\tau)}/V_{it}) = [C_{t+\tau} - C_t] + a_2[\underline{X}_{i(t+\tau)} - \underline{X}_{it}] + [a_4 + a_5 H_i][D_{(t+\tau)} - D_t]. \quad (3)$$

Once again, $[\underline{X}_{i(t+\tau)} - \underline{X}_{it}]$ drops from the analysis. The log of price differences can then be regressed on the change in designation indicators and a matrix of dummy variables that take a value of -1 in the period of initial sale (t), a value of 1 in the period of repeat sale ($t + \tau$) and zero in all other periods. The Cs then become the estimated coefficients on the dummy variables.

4 Data

Data are for sold properties with single family dwellings located in neighborhoods in Lincoln, NE that are designated as historic and for similar properties in matching control neighborhoods. The neighborhoods are listed in Table 1 and shown in Fig. 1. All properties in a designated area receive designation. Table 1 also shows the year in which a neighborhood was designated as historic and the number of properties sold in the neighborhood during the 1990–2007 period. Note that we count only those properties with complete data records. Due to some missing data, this number is smaller than the actual number of properties sold in each neighborhood. The earliest neighborhood designation was in 1980. The latest was in 2002. Most neighborhoods received designation in the 1990s.

Each designated neighborhood is paired with a control neighborhood. Criteria for developing the control neighborhoods include similarity in general characteristics, age, size and style of buildings, and similarity of demographic characteristics. Input from the county assessor's office and a local preservation expert were instrumental in selecting the control neighborhoods.

Data on dates of sale and sale prices were gathered for all properties in the historic and control neighborhoods from the county assessor's office. The use of market sale

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[2] See Abraham and Schauman (1991),Baroni et al. (2007) and Case and Shiller (1989).

Table 1 Neighborhoods with historic designation and the year designated

Designated neighborhood	Year designated	Number of property sales 1990–2007
Chas Creighton	1985	74
East Campus	2002	157
Elm Park	1991	156
Everett	1998	117
Franklin Heights	1995	115
Hawley	1998	51
Mt. Emerald	1980	41
South Bottoms	1986	598
Woods Park	1991	154

prices in housing regressions is not unprecedented. Clark and Herrin (2000) used market sale prices when examining the impact of school district choice on property values for residential homes. In a related study, Dehring et al. (2006) studied the economic impact of stadium announcements on residential sale prices. Although these previous studies have not considered the economic implications of historical designation in relation to property values, the studies support sale price of a residential property as a form of value. Asabere and Huffman (1994a,b) use market prices to analyze the impact of designation on condominiums and properties with façade easements. Ford (1989) looks at the impact of designation on single family house prices.

A clear restriction in the use of sale price information is that the sample will consist only of those properties sold within the time period considered. Using sale price also ignores underlying issues as to why properties were bought and sold. Furthermore, sale prices limit temporal analysis, for properties sold in 1 year may not be the same as properties sold in another year. However, we were also able to analyze a subsample of properties that were sold at least twice during the sample period.

Data pertaining to the properties in the designated and control areas were also obtained from the county assessor's office and from the 2000 census. The measures obtained and their descriptions are shown in Table 2. The first part of the table shows data obtained from the assessor's office. SalePrice is the recorded sale price for a parcel and house. The nine variables "ALLn" are dummy variables that take a value of 1 when a property is within either designated neighborhood n or its control group. The other assessor-derived variables are self explanatory.

Census data were used to derive the hedonic measures relating to neighborhood characteristics. To develop this data, enlargements of the neighborhoods in Fig. 1 were used to identify the census blocks in each designated and control neighborhood. Census block data were then aggregated into neighborhood data and percentages were calculated based on household and housing unit data developed for each designated and control neighborhood.

Table 3 shows descriptive statistics for the properties sold in the nine historic neighborhoods and their controls from 1990 through 2007. Mean sale prices are very similar between properties in designated neighborhoods and their control neighborhoods. The
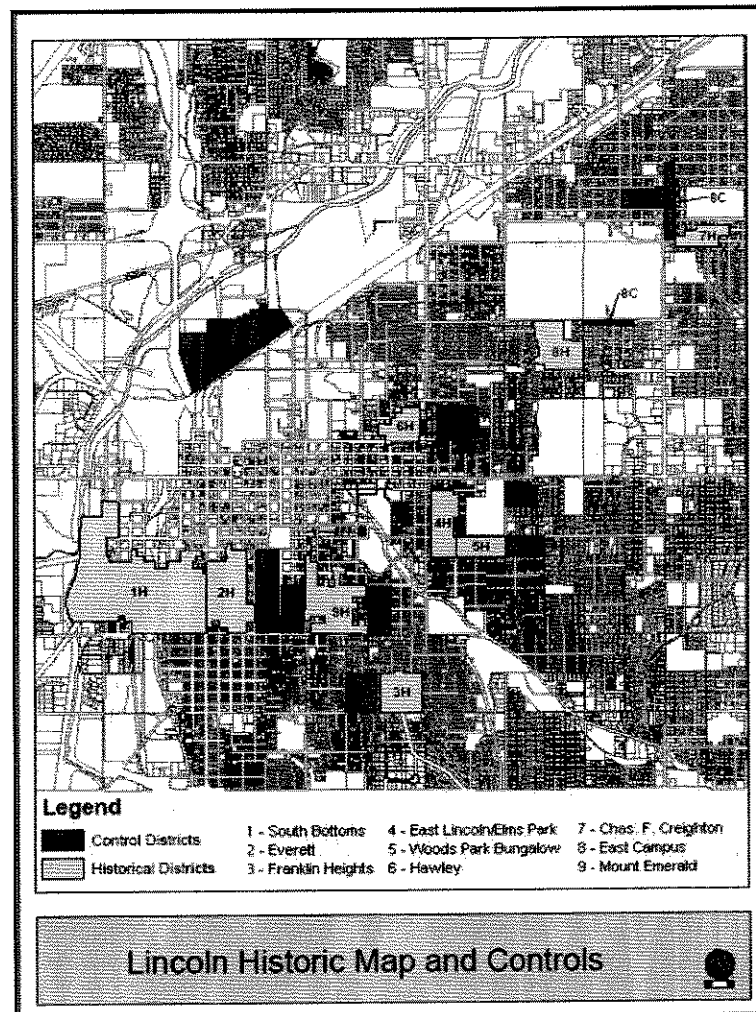
Fig. 1 Map of neighborhoods with historic designation and their paired control neighborhoods

main differences between the two samples are the higher percentage of owner-occupied properties in the designated neighborhoods and the greater standard deviation in some of the housing stock variables for properties in designated versus non-designated neighborhoods.

5 Price results

In Table 4, we show estimates from models of the effect of historic designation on sale prices for properties in the nine pairs of historic designated and control neighborhoods during the 1990 to 2007 period. Using a difference-in-difference model, we

Table 2 Variables and the definitions

Variable	Definition
SalePrice	Market sale price
ALL1–ALL9	Dummy variable for each of nine neighborhoods and its control. 1 = Property is in indicated neighborhood or control, regardless of designation. 0 = property is not in indicated neighborhood or control, regardless of designation.
Bath02	Number of two-fixture bathrooms
Bath03	Number of three-fixture bathrooms
Garage	Number of stalls in garage or 0 if no garage
Bedrooms	Number of bedrooms
Age	Age of the structure in the year it was sold
Sqft	Number of square feet in dwelling
Lot size	Assessed land value in 2006
Condition	Discrete variable showing average condition of property. 1 = Low, 3 = Average, 6 = Excellent
PHHA	Percent of Households with householder that is Asian
PHHB	Percent of Households with householder that is Black
PHHH	Percent of Households with householder that is Hispanic
PHHW	Percent of Households with householder that is White
PHH65	Percent of Households where one or more persons is over 65
PUOWN	Percent of Housing Units Owner Occupied

Table 3 Descriptive statistics for sold properties 1990–2007

	Properties in designated neighborhoods		Properties in non-designated neighborhoods		Entire Sample	
	Mean	SD	Mean	SD	Mean	SD
Sale price	$72,824	$47,545	$72,855	$35,119	$72,837	$42,560
PHHA	1.72	2.13	3.31	3.42	2.41	2.88
PHHB	3.55	2.04	4.06	2.48	3.77	2.26
PHHH	6.89	5.01	4.11	2.06	5.67	4.23
PHHW	87.64	6.62	87.22	8.74	87.46	7.62
PHH65	14.62	4.89	11.79	4.33	13.38	4.86
PUOWN	51.52	22.51	38.09	23.00	45.65	23.68
Bath02	0.3	0.5	0.3	0.5	0.3	0.5
Bath03	1.3	0.6	1.4	0.6	1.4	0.6
Garage	0.9	0.8	1.1	0.9	1.0	0.9
Bedrooms	2.7	1.0	2.7	0.8	2.7	0.9
Age	81.23	16.22	77.93	20.93	77.79	18.49
Sqft	1,418	712	1,340	508	1,384	632
Lot size	$24,708	$8,872	$25,601	$6,647	$25,098	$7,988
Condition	3.0	0.5	3.0	0.5	3.0	0.5
Num of observations	1,463		1,134		2,597	

Table 4 Sale price analysis

	(1)	(2)	(3)	(4)
Intercept	−337,451***	−364,474***	−370,919***	−337,193***
ALL1 (Chas Creighton)	4,131	6,490	8,067	−37,422***
ALL2 (East Campus)	10,501***	12,624***	18,275***	95,841***
ALL3 (Elm Park)	−9,034***	−8,237***	−7,603**	−7,625***
ALL4 (Everett)	55,490***	58,181***	60,975***	109,860***
ALL5 (Franklin Heights)	5,824**	6,847**	7,450**	37,328***
ALL6 (Hawley)	29,424***	29,456***	32,967***	76,543***
ALL7 (Mt. Emerald)	20,962***	23,431***	25,811***	−58,704***
ALL8 (South Bottoms)	39,265***	39,835***	42,309***	−6,189**
Designated Neighborhood Sale (H_{it})	12,257***	8,039**	−11,449	6,189*
Post Designation Sale All (D_{it})	–	−450	7,068	1,266
Post Designation Sale ($H_{it}*D_{it}$)	–	4,952*	33,080***	2,793
Age*Designated Neighborhood Sale	–	–	246*	–
Age*Post Designation Sale All	–	–	−107	–
Age* Post Designation Sale	–	–	−351***	–
Post Designation Sale All—Years Since Designation	–	–	–	7,443***
Post Designation Sale—Years Since Designation	–	–	–	343
2 Fixture baths	5,291***	5,224***	5,307***	5,218***
3 Fixture baths	1,644*	1,580	1,742*	1,605*
Garage	5,946***	5,950***	5,982***	5,984***
Bedrooms	2,790***	2,792***	2,675***	2,811***
Age	−119	−122	−89	−117
Age^2	−1.59*	−1.55*	−0.89	−1.57*
Square feet	17.82***	17.83***	17.27***	17.85***
Square feet^2	0.0008	0.0008	0.0009*	0.0008
Lot size	0.42	0.41	0.47	0.39
Lot size^2	0.000006	0.000006	0.000004	0.000007
Condition	5,569***	5,613***	5,651***	5,628***
TimePast1989	4,857***	4,744***	4,721***	−2,877
TimePast1989^2	−42*	−40*	−39*	−40*
Percent households Asian	8,802***	9,082***	8,911***	8,854***
Percent households Black	−5,170**	−4,372*	−4,700*	−3,620
Percent households Hispanic	−635	−547	−588	−647
Percent households White	3,441***	3,667***	3,673***	3,478**
Percent households over 65	−2,718***	−2,554***	−2,748***	−2,306***
Percent units owner occupied	513***	535***	587***	549***
$\overline{R}^2$	0.68	0.68	0.68	0.68

* Statistically different than zero at 90% using two-tailed test
** Statistically different than zero at 95% using two-tailed test
*** Statistically different than zero at 99% using two-tailed test

are able to assess whether the differences in property values between designated and control neighborhoods always existed, or instead arose after historic designation. In other words, we will be able to separate the "neighborhood" effect from the impact that designation, in and of itself, has on market prices.

Model (1) in Table 4 shows results from the "standard" model. After accounting for property and neighborhood characteristics, houses in designated neighborhoods sold for about $12,300 more than houses in control neighborhoods. But again, we cannot draw a distinction whether the higher values are due to the act of designation or unmeasured neighborhood characteristics. The second, third, and fourth columns in Table 4 begin to answer this question.

In Table 4, the variable "Post Designation Sale All" [referred to as D_t in Eq. (1)] is a dummy variable that takes a value of 0 if the sale takes place in either a designated neighborhood or its control in the period before designation and a value of 1 if the sale takes place after designation. "Post Designation Sale" [referred to as $H_i * D_t$ in Eq. (1)] is a dummy variable that takes a value of 1 if the sale takes place in a designated neighborhood after designation occurs and takes a value of 0 otherwise. This is the difference-in-difference operator and indicates how the act of designation influences sale prices. In model (2) in Table 4, the coefficient on "Post Designation Sale All" is small and statistically insignificant. The coefficient on "Post Designation Sale" indicates that once designation occurs, sale prices on houses in designated neighborhoods rise about $5,000.

The coefficient on "Designated Neighborhood Sale" indicates that whether pre- or post-designation, prices in neighborhoods destined to be designated are about $8,000 higher than prices in control neighborhoods, after accounting for the control variables that we included in our model.

Model (3) in Table 4 investigates whether the impact of designation on sale price varies with the age of a home. The estimated coefficient on the interaction of age and "Post Designation Sale" is negative and statistically significant. This result suggests that designation has a larger impact on younger homes than older homes within designated neighborhoods. The influence of designation on sale price declines by $351 for each 1-year increase in the age of the home in the year it is sold.

In model (3), the coefficient on "Post Designation Sale" is quite large and statistically significant. However, the average age of post designation sale homes is 82.7 years. Consequently at the mean age, the impact of designation is to raise prices by about $4,100. This is very consistent with the result from model (2). In model (3), the coefficient on "Designated Neighborhood Sale" is large and negative, although not statistically significant. The coefficient on "Age" interacted with "Designated Neighborhood Sale" is positive and significant. As seen in Table 3, the average age of homes that are designated neighborhood sales is 81.2 years. Combining all of this information, at the mean age, a designated neighborhood sale increases prices by about $8,500. This result is consistent with the result in model (2) as well.

Model (4) in Table 4 addresses the question of whether the increase in sale price due to designation occurs all at once or whether it occurs gradually after designation. The variable "Post Designation Sale All—Years Since Designation" measures the years since designation for a post designation sale in either an historic neighborhood or its control. The variable "Post Designation Sale—Years Since Designation" measures the

number of years a sale in a designated neighborhood occurs after designation.[3] If the increase in value occurs all at once for houses that are in designated neighborhoods, then just the "Post Designation Sale" variable should have a positive and statistically significant coefficient. If the increase in value for designated homes happens over time, the "Post Designation Sale—Years Since Designation" variable should have a positive and statistically significant coefficient. As seen in the last column in Table 4, neither coefficient is statistically significant, even at the 10% significance level. The results of this model are inconclusive. However, the coefficient on the "Post Designation Sale—Years Since Designation" variable would be statistically significant at the 13% significance level, and the estimate is that the influence of historic designation on sale prices would rise by about $340 per year. Note also that there is a large and statistically significant coefficient on the "Post Designation Sale All—Years Since Designation" variable, and the coefficient on the $Timepast1989_{it}$ variable is now negative and statistically insignificant. The coefficient on the "Post Designation Sale All—Years Since Designation" variable appears to be reflecting the inflation in home prices over time.

The remaining results in Table 4 show the influence of housing and neighborhood characteristics on sale prices. Almost all of the hedonic measures have the expected impact on prices, regardless of model specification. An increase in the number of two- (three-)fixture bathrooms increases value by $5,000 ($1,600). Given average sale prices of approximately $73,000 over the 1990–2006 period this amounts to a 7% increase. Additional stalls in a garage increase value by almost $6,000 per stall, or about 8%. An additional bedroom increases price by a little less than $3,000.

All else equal, properties with newer dwellings sell for higher prices than properties with older dwellings. The relationship is non-linear. The results show that the larger the number of square feet in the dwelling, the greater the sale price, with each square foot adding approximately $17 to value. This relationship is linear. Lot size seems to have little influence on sale price. Properties that are in better condition have higher sale prices than other properties, as indicated by the assessor's measure of condition.

The model in Table 4 also has one additional variable, $TimePast1989_{it}$. It is the number of years past 1989 in which the sale of property i occurs. If a property sells in 2000, for example, $TimePast1989_{it}$ is equal to 11. If market prices are appreciating over time, its coefficient should be positive, which it is. Prices appreciated by an estimated $4,700 to $4,900 in the first year (in models 1–3), but the rate of increase falls over time, as indicated by the negative coefficient on the square of the $TimePast1989_{it}$ variable.

Among neighborhood characteristics, sale prices increase as neighborhoods become relatively more Asian or white, and decrease in neighborhoods that have relatively more black residents or residents age 65 and over. Every one point increase in the percentage of housing units that are owner occupied increase price by about $500.

Overall, using the difference-in-difference model in Table 4 we find that historic designation does raise property values in the Lincoln, Nebraska neighborhoods that we examine, and that designation has the greatest effect on the sale price of younger properties. We do not find conclusive evidence of whether the impact of historic

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[3] If a sale occurs before designation, it takes a value of zero.

Table 5 Repeat sale analysis

Variable	1108 Observations coefficient	178 Observations coefficient
Time between sales (τ)	0.048 (0.001)**	0.030 (0.002)**
Change in Post Designation Sale All ($D_{i(t+\tau)} - D_{it}$)	0.019 (0.028)	0.169 (0.072)*
Post Designation Sale ($H_i * D_{i(t+\tau)} - D_{it}$)	−0.012 (0.038)	0.009 (0.055)

Standard errors in parentheses
* Statistically different than zero at 99% using two-tailed test
** Statistically different than zero at 95% using two-tailed test

designation on sale prices is a one-time increase, or whether the effect aggregates over the years of post designation.

6 Repeat sales

There are 1,108 observations for properties that were repeat sales.[4] For 930 observations, both sales occurred either before or after designation. For these 930 observations, $D_{(t+\tau)} - D_t$ is equal to zero and only time between sales will affect price. However, there were 178 properties where the first sale occurred before designation and the second occurred after designation. For these observations, $D_{(t+\tau)} - D_t$ is equal to one. We estimate Eq. (2) using both the 1,108 observation sample and the 178 observation sample.

The results of the repeat sale analyses are shown in Table 5.[5] In both samples, the coefficient on τ suggests that prices increase from three to five percent per year. In the larger sample, the positive coefficient on ($a_4[D_{(t+\tau)} - D_t]$) suggests that when a neighborhood transitions from non-designated to designated, prices in both that neighborhood and its control appreciate nearly 2% faster than when no change in status occurs. However, this coefficient is not statistically significant in the larger sample. In the smaller sample, the positive and statistically coefficient on ($a_4[D_{(t+\tau)} - D_t]$) suggests that there is a constant component to the appreciation in price between pre- and post-designation sales (in either designated or control neighborhoods), regardless of the length of time between the initial and repeat sale. The coefficient on ($a_5 H_i[D_{(t+\tau)} - D_t]$) is statistically insignificant in both samples, suggesting that designation does not affect appreciation rates in the designated neighborhood differently than its control.

Table 6 shows results of weighted OLS estimation of appreciation rates from Eq. (3).[6] As before, we run this analysis for the sample of all repeat sales and the smaller sample of repeat sales that cross designation. For the larger sample, change in

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[4] Note that if the same property sold three times during our sample years, it would account for two repeat sales.

[5] We performed tests for heteroskedasticity with respect to time between sales and its square for all equations in this section. We found and corrected for heteroskedasticity in all cases.

[6] Weights were derived to address heteroskedasticity following Abraham and Schauman (1991).

Table 6 Repeat sale analysis using WRS Model

Variable	1108 Observations coefficient	178 Observations coefficient
Change in Post Designation Sale All $(D_{i(t+\tau)} - D_{it})$	0.02 (0.03)	0.22 (0.10)*
Post Designation Sale $(H_i * D_{i(t+\tau)} - D_{it})$	−0.03 (0.04)	0.01 (0.06)
D1990	0.35 (0.11)**	−0.43 (0.42)
D1991	0.38 (0.05)**	0.26 (0.12)*
D1992	0.38 (0.05)**	0.32 (0.13)*
D1993	0.47 (0.05)**	0.34 (0.14)*
D1994	0.55 (0.05)**	0.34 (0.13)**
D1995	0.67 (0.05)**	0.55 (0.10)**
D1996	0.67 (0.05)**	0.35 (0.14)*
D1997	0.75 (0.05)**	0.43 (0.15)**
D1998	0.80 (0.05)**	0.51 (0.16)**
D1999	0.87 (0.05)**	0.62 (0.17)**
D2000	0.94 (0.05)**	0.72 (0.18)**
D2001	0.92 (0.05)**	0.56 (0.18)**
D2002	0.95 (0.06)**	0.50 (0.19)**
D2003	1.03 (0.06)**	0.65 (0.21)**
D2004	1.05 (0.06)**	0.65 (0.21)**
D2005	1.05 (0.05)**	0.59 (0.21)**
D2006	1.12 (0.06)**	0.63 (0.20)**
D2007	1.09 (0.06)**	0.53 (0.22)*

designation has no statistically significant impact on appreciation rates in either the designated or control neighborhood. Changes in the indices indicate that prices are appreciating about 4% per year, a result very consistent with the results in Table 5. For the smaller sample, the positive and statistically coefficient on $(a_4[D_{(t+\tau)} - D_t])$ again suggests that there is a constant component to the appreciation in price, regardless of the length of time between the initial and repeat sale. Further, the coefficient on $(a_5 H_i [D_{(t+\tau)} - D_t])$ is not statistically significant, suggesting that designation does not affect appreciation rates in the designated neighborhood differently than its control. These results are consistent with Table 5 as well. However, the indices indicate an average appreciation rate of about 5%, which is above the rate shown in Table 5.

7 Conclusion

This study added to an existing literature that has measured the relationship between historic designation of neighborhoods and property values in US cities by examining nine historically designated neighborhoods in Lincoln, NE. The study contributed to that literature in two ways. First, the study estimated a hedonic model of property values using sale price data, rather than assessed prices. Assessed prices have been used in most previous research.

Second, the study estimated a difference-in-difference model to assess the influence of historic designation on neighborhood property values. This was possible because we assembled a time-series, cross-section dataset containing home sales during the 1990–2007 period. For six of the nine historic neighborhoods, this data set contained sales from both before and after historic designation. After controlling for observable neighborhood and housing characteristics, we found a positive impact of historic designation on selling prices for homes in designated neighborhoods in the years after designation. The values of homes in designated neighborhoods grew on average by $5,000 for sales that occurred in the years after historic designation. Further, we found that historic designation had a larger effect on sale price of younger properties. The influence of designation on sale price declined by $351 for each 1-year increase in the age of the home at the time of its sale. Finally, we ran tests but did not find conclusive evidence on whether the impact of historic designation on sale prices was a one-time increase, or an effect that rose over time post designation.

These results showed the advantages of using a time-series, cross section data set with pre- and post-treatment observations to evaluate a treatment, such as historic designation, on neighborhood property values. This approach allowed us to more clearly isolate the influence of historic designation rather than other unobserved neighborhood characteristics on property sale prices. Difference-in-difference models also can be utilized to determine whether historic designation leads to a one-time increase in sale price, an increase in the annual growth rate of property values, or both. More generally difference-in-difference models can be used in a variety of contexts such as the impact on neighborhood property values from new parks or other green space, or the impact of new businesses or institutions that influence traffic levels or noise pollution within neighborhoods.

However, we also noted that difference-in-difference models can yield a different result than repeat sales models, which can be estimated using that subset of properties in the time-series, cross-section data set that sold more than once during the study period. Repeat sales models can control for unobserved characteristics of individual properties as well as unobserved neighborhood characteristics. In contrast to results from the difference-in-difference model, estimates of the repeat sales model did not find a statistically significant impact of designation on sale price growth. This indicates that the results of our difference-in-difference models are not robust in this alternative specification. More generally, these results imply that future analysis using panel data sets may utilize both the difference-in-difference and the repeat sales models for a more complete empirical analysis.

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