Gabriel M. Ahlfeldt and Alexandra Mastro

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Valuing Iconic Design:
Frank Lloyd Wright Architecture in Oak Park, Illinois

Gabriel M. Ahlfeldt*

Alexandra Mastro

London School of Economics

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Abstract: This study investigates the willingness of homebuyers to pay for co-location with iconic architecture. Oak Park, Illinois was chosen as the study area given its unique claim of having 24 residential structures designed by world-famous American architect Frank Lloyd Wright, in addition to dozens of other designated landmarks and three preservation districts. This study adds to the limited body of existing literature on the external price effects of architectural design and is unique in its focus on residential architecture. We find a premium of about 8.5% within 50-100m of the nearest Wright building and about 5% within 50-250m. These results indicate that an external premium to iconic architecture does exist, although it may partially be attributable to the prominence of the architect.

Keywords: Frank Lloyd Wright, hedonic analysis, iconic architecture, property prices

JEL: R21, Z11

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* DEPARTMENT OF GEOGRAPHY AND ENVIRONMENT AND SERC, HOUGHTON STREET | LONDON WC2A 2AE, G.AHLFELDT@LSE.AC.UK,WWW.AHLFELDT.COM

1. Introduction

While the built environment plays a significant role in the overall appeal of a neighbourhood, few studies have tried to quantify the external effects of high quality design. This study will contribute to the limited body of research on the subject and consider the premium achieved by houses in the vicinity of iconic architecture. The results of this study should be of interest to local governments and communities who could use the development of iconic structures to increase the appeal and prestige of their areas. In addition, a positive result would show that the preservation of architecturally significant buildings can be warranted.

There are two major challenges faced by researchers conducting empirical analyses on the value of architecture; first, since a certain architectural design or style may be liked by some and not by others, it is difficult to determine explicitly what constitutes 'good' design; and second, many of the most significant architectural designs are found in public buildings such as stadia or museums and in these cases the benefit of the architectural element cannot be isolated from the use of the building. This study circumvents both of these issues by focusing on residential properties designed by a well-known architect, Frank Lloyd Wright.

While the current media culture has given rise to many famous architects such as Frank Gehry, Zaha Hadid, and Shigeru Ban (to name just a few), who are known for their distinctive designs, Frank Lloyd Wright occupies a unique position among the general populace in terms of their familiarity with both his name and his architectural style. In a national survey in 1991 the American Institute of Architects named Wright the "greatest American architect of all time" (Brewster, 2004). His overwhelming popularity permits this study to proceed under the assumption that his designs are considered architecturally significant and add prestige to the neighbourhoods in which they are located. In addition, unlike many architects who became well-known for large public projects, Wright was primarily a residential architect. This allows for the separation of design and use since the subject properties are privately owned and the only benefit to outsiders is their exterior appearance. Oak Park, Illinois provides a unique case study for empirical research as Wright built 24 homes in the village between 1892 and 1914.

Wright's designs are considered by many to be works of art. Residents are likely to benefit both from the added prestige of being located near a Wright home and also from the view as they are likely to pass by the home regularly. As long as homebuyers acknowledge these benefits and bid up the prices of houses near Wright houses, the benefit will be capitalised in property prices. To assess whether such a premium exists, we conducted a spatial hedonic property price analysis, guided by a simple bid-rent model. Previewing our findings, the study will conclude that an external premium to iconic architecture does exist and that the effect steeply decays with distance. In addition, significant benefits were found to be associated with location in one of the designated preservation districts as well as proximity to designated landmarks more generally. These results should be of interest to local and national governments and communities as they illustrate the potential for promoting the attractiveness and desirability of local areas through iconic architecture.

2. Frank Lloyd Wright and the Prairie Architectural Style

Frank Lloyd Wright was born in Wisconsin in 1867 and spent most of his early years in Madison. He did not formally train as an architect but instead completed two semesters of civil engineering before moving to Chicago in 1887. In Chicago, he worked directly under Louis Sullivan, a prominent architect at that time, and was greatly influenced by Sullivan's strong belief that form should follow function and that American architecture should not be overly influenced by European styles. In 1893 Wright started his own practice in Chicago, but in 1898 he relocated to a studio attached to his home in Oak Park, a suburb directly west of Chicago. Wright was at the forefront of the uniquely American Prairie architecture movement which was based on the idea that a structure should be designed to fit with its natural surroundings. The Prairie architects "rejected the historic styles because they, like many of their predecessors in the nineteenth century, believed themselves to be living in a new cultural age whose architecture deserved an aesthetic expression of its own" (Sprague, 1986, p. 7).

The Prairie style is characterised by strong horizontal lines, geometric shapes and a lack of ornamentation. The materials used – including wood, stucco, brick and concrete – were never painted and therefore retained a natural appearance. Gently sloping roofs, deep overhangs and rows of small windows are typical design features. Geometric stained glass windows are a unique feature that defines many of Wright's buildings.

Between 1892 and 1914, Frank Lloyd Wright completed several homes in Oak Park for prominent Chicago families. There are 24 properties in total, 23 of which (excluding 400 S Home Street) are located in close proximity to each other as shown in Figure 1. The homes are all privately owned with the exception of Wright's home and studio which is open to the public. While this study is not focused on the internal price premiums achieved by Wright houses, five properties sold between 2003 and 2009 at a statistically significant 41 percent price premium. The respective transaction will be omitted from the analyses.

3. Background and Existing Literature

There is large and growing body of hedonic house price research in the tradition of Rosen (1974) demonstrating that the price of a property not only depends on the characteristics of a building itself, but also on the amenities its location has to offer. Glaeser et al. (2001) classify four basic categories of urban amenities: the quality and variety of consumption goods; the physical setting, including aesthetic and in particular architectural beauty; public services; and efficient transport. While Florida et. al. (2009) in a recent survey find that the perceived beauty or aesthetic character of a location is among the most significant factors for community satisfaction, this dimension has been difficult to address in house price capitalization research. There have been several studies completed which focus on the premiums achieved for a variety of visually attractive amenities such as lakes, parks, open space, wetlands, streams and golf courses among others (e.g. Anderson & West, 2006; Do & Grudnitski, 1995; Mahan, Polasky, & Adams, 2000; Wu, Adams, & Plantinga, 2004), but to date, there has been limited research on the external price effects of architectural design.

By measuring the premium for proximity to Wright houses this study is considering iconic architecture as a consumption amenity to residents. Ahlfeldt & Maennig (2010b) provide a typology of characteristics of iconic architecture and its economic impacts. A distinctive feature of iconic architecture, accordingly, is that the decorativeness, colour, texture, quality of surface materials, as well as the spatial configuration, the shape and the massing produce a unique and condensed image with high recognition value. While the development cost is higher for iconic architecture compared to functional design(Vandell & Lane, 1989), iconic architecture has the potential for positive economic impact due to: [1] spending by tourists visiting iconic architecture, [2] image effects, increased social capital and consumer optimism, [3] a direct utility derived from the aesthetic setting and [4] increased identification and civic pride related to a landmark. Through an increase in demand for space in proximity to iconic architecture, these effects potentially capitalize into property prices.

While this study is unique in its focus on iconic residential architecture, there are a number of related strands in the house price capitalization literature. A few studies have attempted to assess the external property price effects of facilities with an iconic design, especially sports stadia (Ahlfeldt & Kavetsos, 2011; Ahlfeldt & Maennig, 2009, 2010a). While these studies indicate that architectural landmark facilities exhibit positive effects on their surroundings, their focus on arenas makes it difficult to isolate the benefits of the design element from the use of the building. Another strand of literature has concentrated on internal price effects of architectural design, i.e. the willingness to pay for living or working inside a building with a particular design. Hough and Kratz (1983), Vandell and Lane (1989) and Gat (1998) all studied the effect of architecture on commercial properties and found that a rental premium was achieved by buildings with ‘good’ architectural design. Other studies find that premiums can be achieve for certain architectural styles (Asabere, Hachey, & Grubaugh, 1989), exterior design features (Moorhouse & Smith, 1994) and new urbanism communities (Song & Knaap, 2003). These findings are informative for our case as they demonstrate that markets value architectural design, in principle. However, we distinguish our contribution from this strand of research by concentrating on the effect of iconic architecture on prices of nearby buildings, i.e. a technological externality that is not traded on the market.

Another strand of literature which is relevant to this study is historic preservation research, because even though the focus of research in this area is often not architecture per se, architecture is normally one of the main reasons a structure is given landmark status or an area is designated as a historic district. Similar to studies focused on architecture, studies on historic preservation mostly test the internal impact of how house prices change when a district is established or landmark status is granted. Leichenko et al (2001) provide a thorough summary of historic preservation research between 1975 and 2001 that indicates mixed results. Their own analysis of nine Texas cities showed that effects were, mostly, positive. Lately, studies have also started to consider the external benefits of landmarks which are more directly related to this study. Looking at densities within census tracts (Coulson & Lahr, 2005), block groups (Noonan, 2007) or various distance rings (Lazrak, Nijkamp, Rietveld, & Rouwendal, 2010; Noonan & Krupka, 2011), these studies have all found a premium associated with the proximity of an increasing number of historic landmarks. Similarly, Ahlfeldt and Maennig (2010c) using a range of distance, density and potentiality measures, find significantly positive effects associated with proximity to and variety of historic landmarks. While nearby historic landmarks and preservation districts are incorporated into this analysis, the main objective is to better isolate any visual and prestige effect that are specific to Wright houses in order to avoid them being confounded with potentially spatially correlated general heritage effects.

4. Study Area, Data and Methodology

Oak Park, Illinois is located on the west side of Chicago, approximately 16km from the city centre. While it is technically designated as a village, it would be considered by residents as a suburb of Chicago. It covers an area of approximately 4.7 square miles and, as of the 2000 US Census, had 52,524 residents and 23,723 housing units. The village is predominately white at 67 percent but also includes 22 percent African Americans. Oak Park is considered a middle to upper middle class suburb and according to the 2000 US Census the median income for the village was $59,183 compared to $38,625 for Chicago. The area is dominated by typically suburban medium density single family residences along relatively wide rectilinear streets. The landscape is not particularly sloped and there are no natural barriers (mountains, forests, etc.) that would prevent access to or views of Wright buildings. A map of Oak Park is shown in Figure 1.

The analysis of this study includes 3,334 observations of homes that sold in Oak Park between 2003 and 2009 (net of transactions of Wright houses). The transactions include detached single family homes and townhouses (attached single family homes). Several structural characteristics as well as sales price and year are available from the Cook County Assessor's Office. The role of the Cook County Assessor's Office is to value properties in the county for tax purposes. Therefore, they have a database of all properties which they continually update as they receive permit information from the municipality on new houses or renovations. When they receive a permit, a surveyor is sent to the property to assess the changes. While the surveyor generally does not enter the house, he/she will try to speak to the owner and request information about the interior of the house. However, if the owner is unavailable the surveyor will estimate interior characteristics based on experience and therefore all of the data may not be completely accurate. When a house is sold, the seller must file a transfer declaration form with the Recorder of Deeds and the Assessor's Office adds the sales price information from this form to its database. For each property, the Cook County Assessor provided the information summarised under structural characteristics in Figure 3. This information is extensive and should be sufficient to control for all of the physical components that give a house its value. All houses that sold under foreclosure were excluded from the analysis in order to avoid bias in the results. In addition, five Wright houses that sold between 2003 and 2009 have also been excluded.

To complement the data obtained from the Cook County Assessor's Office, a number of geographic variables were generated in a GIS environment to control for characteristics that are external to the property and potentially correlated with proximity to Wright houses. Typically, a powerful determinant of the desirability of location is school quality (Gibbons &

Machin, 2008). There are eight public primary schools that are accessible to residents depending on where they live within the village and two public middle schools that can be attended depending on primary school. To capture the effects of school quality, dummy variables were assigned to indicate which primary school district a property is located in. In addition to public schools, the amenities of the village include several transportation connections to downtown Chicago, a number of recreational park areas as well as a town centre with stores, restaurants and other entertainment. Oak Park has access to two subway lines, the blue and the green lines, as well as easy access to the Eisenhower Expressway at Harlem Avenue/ Harrison Street and Austin Avenue/ Harrison Street. The blue line follows the route of the expressway and can be accessed at three stops: Harlem Avenue, Oak Park Avenue and Austin Avenue. The green line runs between North and South Boulevard and can be accessed at four stops: Harlem Avenue, Oak Park Avenue, Ridgeland Avenue and Austin Avenue. The town centre is bordered on the west by Harlem Avenue, on the east by Oak Park Avenue/Euclid Avenue, on the south by South Boulevard/Pleasant Street, and on the north by Ontario Street. Within a GIS environment, variables are generated that capture the distance to the town centre, the nearest subway and park. The impact of the motorway is potentially ambiguous. To account for countervailing externalities emerging from the associated benefits (accessibility) and cost (noise and pollution), we distinguish between the road distance to the nearest highway entrance and the straight-line distance to the motorway itself.

Oak Park's easy access to downtown Chicago made it an obvious location choice when prominent individuals began leaving the city in the early 20th century for more space and less pollution in peripheral areas. Frank Lloyd Wright designed 24 homes in Oak Park including his own between 1892 and 1914. The majority of the homes are located north of the town centre. Today the area is part of the Frank Lloyd Wright- Prairie School of Architecture Historic District created in 1972 by the Village of Oak Park and listed on the National Register in 1973. The district is bounded roughly by Division Street to the north, Lake Street to the south, Ridgeland Avenue to the east, and Marion Street and Woodbine Avenue to the west (see Figure 1). There are 1,500 buildings within the boundaries and 1,300 contribute to the historic character of the district with homes designed in several styles including Prairie, Queen Anne, Stick, Italianate, Shingle, Gothic, Revival, Tudor Revival, Classical Revival, Colonial Revival, Art Deco, Craftsman, Bungalow and American Foursquare (Village of Oak Park Community Planning and Development, 2010a).

There are also two other historic districts in Oak Park: the Ridgeland-Oak Park Historic District and the Gunderson Historic District. The Ridgeland-Oak Park Historic District was listed on the National Register in 1983 but not locally until 1994. There are around 1,700 buildings in the district and 1,500 contribute to the architectural character. The Ridgeland-Oak Park Historic District contains most of the same architectural styles as the Frank Lloyd Wright-Prairie School of Architecture Historic District. However, there are few examples of the Prairie style (Village of Oak Park Community Planning and Development, 2010c). The Gunderson Historic District is small in relation to the other two and only includes two subdivisions with single-family homes and apartment buildings developed by the firm S.T. Gunderson and Sons during the first decade of the 20th century. The single family homes are mostly in the American Foursquare architectural style (Village of Oak Park Community Planning and Development, 2010b).

Dummy variables have been assigned to observations in each historic district which should provide additional neighbourhood controls as well as capture the effect of historic designation. Designation can have both a positive and negative impact on house prices. On the positive side, it provides residents with the security that the houses around them cannot change dramatically and there is a prestige that comes with living in an area of historical importance. However, there are costs including potentially higher maintenance costs and the inability to change the structure which could reduce profitability to the owner. Besides the three heritage districts, 52 individual landmarks feature on the Oak Park Historic Landmark Lists, which will be incorporated into the empirical models in varying spatial setups.

As with any house price study of this kind, a critical question is how to set up an appropriate hedonic model with the data at hand. While hedonic models for their theoretical foundation typically refer to Rosen (1974), the variable selection is often motivated by intuition. As our benchmark specification will deviate from the common practice of other applied house price capitalization studies, we choose to motivate it with a simple bid-rent model that is a derivative of Ahlfeldt (2011) and shares much in common with classic housing models in the spirit of Mills (1972) and Muth (1969). We assume a very simplistic world where identical and mobile individuals at a location i derive a Cobb-Douglas type utility from the consumption of a composite (local) non-housing good (C) and housing space (H).

$$U_i = A_i C_i^{\alpha} H_i^{1-\alpha} \tag{1}$$

where A captures the effect of location related amenities, among others the aesthetic beauty of a place, which shift the utility for any given level of consumption depending on the endowment with amenities n at place i (AE). Residents take the wages $\overline{\omega}$ as given, which net of commuting cost defines the budget for consumption (B_i).

$$A_i = \prod_n e^{\varphi_n AE_{in}}, B_i = \overline{\omega} e^{-\theta d_i} \quad (2)$$

Per unit cost of housing corresponds to what resident are willing to bid, i.e. bid-rent ψ. The price of the consumption good for simplicity is chosen as the numeraire. Within these constraints residents maximize their utility. Mobility of residents implies that residents at all locations maintain the same level of reservation utility, which for simplicity is chosen as $U_i = \overline{U} = 1$. With this restriction, equilibrium bid-rents at location i are determined by wages and commuting cost and the location specific amenity endowment.

$$\psi_i = (1-\alpha)\left(\alpha^\alpha \overline{\omega} A_i e^{-\theta d_i}\right)^{\frac{1}{1-\alpha}} \quad (3)$$

Equation (3), within the constraints of assumptions made, defines the demand for housing in the urban economy. There is, of course, a supply side that needs to be considered to understand the spatial equilibrium of a city. We assume that housing is provided by a homogenous construction sector that uses capital (K) and land (L) as inputs in a Cobb-Douglas production function.

$$H_i = \frac{1}{R} K_i^\beta L_i^{1-\beta} \quad (4)$$

where R is a measure of regulatory restrictiveness that makes the production technology more or less efficient. Construction firms pay a bid-rent for land Ω while the price of capital, which is a composite of all non-land inputs, is the numeraire. First order and zero profit (full entry and exit) conditions imply the equilibrium land rent determined by housing bid rent and the level of regulatory restrictiveness, which can be assumed to be constant across the study area.

$$\Omega_\mathrm{i} = \psi_i^{\frac{1}{1-\beta}} (1-\beta)(\bar{R})^{-\frac{1}{1-\beta}} \quad (5)$$

Substituting the equation (3) in (5) yields the residential land market equilibrium condition, which, taking logarithms, lays the foundation for an empirical test.[1]

$$\log(\Omega_\mathrm{i}) = \xi + \frac{1}{(1-\alpha)(1-\beta)} \sum\nolimits_\mathrm{n} \varphi_n AE_{ni} - \frac{\theta}{(1-\alpha)(1-\beta)} d_{im} \quad (6)$$

Land rents are expected to increase with the amenity endowment and accessibility. It is notable that the marginal effects depend on housing production technology and consumption preferences. Stronger consumption preferences imply that housing consumption is given up more quickly, pushing the relative price for housing and thus leading to stronger marginal price effects.

[1] With $\xi = \log\left[(1-\beta)\left(\frac{1-\alpha}{\bar{R}}\right)^{\frac{1}{1-\beta}} (\overline{\omega}\alpha^\alpha)^{\frac{1}{(1-\alpha)(1-\beta)}}\right]$.

This spatial equilibrium condition can be estimated in reduced form building on the hedonic price model developed by Rosen (1974), which is well-established in housing research. The problem with equation (6) is that the pure value of land, net of the housing structure, is typically not observable directly from property transactions. Under the assumptions made, however, the first order conditions of the supply equation (4) can be used to demonstrate that the pure value of land Ω_i is a linear transformation of the total value of a property ($\psi_i H_i$), which is the composite of the total land value ($\Omega_i L_i$) and the embedded structure (K_i), divided by the corresponding lot size (L_i).

$$\frac{\psi_i H_i}{L_i} = \frac{K_i + \Omega_i L_i}{L_i} = \frac{\beta}{1-\beta}\Omega_i + \Omega_i = \frac{1}{1-\beta}\Omega_i \qquad (7)$$

The reduced form empirical specification we use to estimate equation (6) therefore takes the following form:

$$\log(P_{it}) = \gamma + FLW_i b + HER_i c + X_i d + \phi_j + \varphi_t + \varepsilon_i \qquad (8)$$

where P_{it} is the price per square foot of lot area paid for a property i at time t. FLW, HER, and X are vectors of variables that capture proximity to Wright homes, other heritage buildings and non-heritage related housing and location characteristics, φ_t and ϕ_j represent school district and year effects, and ε_i is an error term. Given the log-linearization, equation (8) should yield parameter estimates that are consistent with equation (6) as the linear transformation will be captured by the intercept.

An alternative to the use of price per square foot of lot area as a dependent variable is the separation of the value of the land parcel from the transaction price. Previous hedonic land price analyses have separated the land value in an auxiliary regression of property prices per land area on time and location fixed effects and covariates capturing the attributes of the buildings (e.g. Ahlfeldt, 2011b). The residual land value is then the price per land area net of the contribution of the housing space and the various characteristics of the building developed on a plot of land. With the residual land value recovered, equation (8) can be estimated including only controls for location, but not building characteristics (and time). We replicate this procedure using block group fixed effects in the fist-stage, which are small enough to control for very local characteristics.[2] One advantage of this two-stage approach is that it yields unbiased internal hedonic parameters in the presence of unobserved (correlated) location characteristics. Throughout all stages of our analysis both approaches yield consistent estimates. While we report land value regression results for the most relevant specifications, we centre our discussion on the price to land area regressions on the grounds that this measure is directly observable.

[2] The property transactions considered spread over 403 block groups within the relatively small study area.

We note that the vector *X* does not include a control for housing size as building density is endogenous in the model and incorporated into the spatial equilibrium condition (6) via the supply side. Adding such a control to specification (8) presumably inflates the explanatory power of the model at the risk of partially absorbing variation in prices that is originally caused by the variables of interest (*FWL*), a so called bad control problem (Angrist & Pischke, 2009). A similar argument applies to socio-economic composition of the neighbourhood as some types of households may tend to locate closer to iconic architecture because of particular preferences and tastes. In specification (8) school district fixed effects, which we include to control for school quality and unobserved location effects, may also capture socio-economic variation to some degree. School districts, however, are relatively large so that we expect sufficient within school district variation to identify proximity to Wright building effects. It is important to note, of course, that the location of Wright buildings themselves could be endogenous, e.g. because they were built at the most suitable locations. Failure to control for these conditions could yield biased estimates. We will provide evidence, however, that controlling for historic conditions reflected in land values does not affect the estimated proximity premium.

We prefer the transaction price per associated land unit (or the residual land value) to be the dependent variable in a hedonic housing analysis since land within our study area is scarce and the supply side can (largely) be ignored. With regard to (missing) controls for the size of a property, this setup stands in some contrast to the common practice in the applied house price capitalization literature, so we decided to run an alternative specification for selected models with the (log) price of a property transaction as the dependent variable which controls (including squares) for lot and floor size. Table 1 gives an overview on the control variables used in this study.

The main (spatial) dimension of interest for this study is proximity to Frank Lloyd Wright homes. Recent house price capitalization studies have used different spatial settings to capture amenity effects. The most popular measure is distance from each observation to the point of interest, with the results stating the (percentage) change in property prices with each additional distance unit away. In many cases, the amenity such as a park or a lake has a use to residents apart from visual impact and therefore the impact is felt over greater distances. Some of the channels through which iconic architecture may capitalize into property prices discussed in section 3 can have effects over larger distances if they are associated with a benefit to a community as whole, e.g. tourist spending [1], image effects [2] or civic pride [4]. To the contrary, the aesthetic utility [3] either associated with direct views out of a window, from a garden or when passing by buildings regularly, canbe felt only over a relatively short distance. Therefore, besides variables capturing distance to the nearest Wright home, a set of dummy variables for properties within mutual exclusive distance rings of 0-50 m, 50-100m, 100-250m, 250-500m, 500-1000m, and 1000m-2000m will be used to allow for non-linearities in the distance effect.

With these distance variables the premium residents attach to having *one* Wright building in close proximity can be measured (*proximity effect*). As demonstrated by Ahlfeldt & Maennig (2010c) for listed historic buildings, there may be additional benefits of having a variety of buildings of a particular style nearby as they jointly constitute a particular character of a neighbourhood. A popular measure to capture the *variety effect* at the expense of ignoring the *proximity effect* is a density variable that counts the number of buildings within a certain distance or tract. We will use distance and density variables in conjunction to test whether, conditional on having one Wright building in the neighbourhood (*proximity effect*), there is an incremental benefit of having several Wright buildings nearby (*variety effect*). One limitation of the density variable is that it restricts the impact of additional Wright buildings to a certain area that has to be defined arbitrarily. Within this area, all Wright buildings are treated in the same way, irrespectively of their distance to a given point of observation. These limitations can be overcome with a potentiality measure that creates an index that incorporates the distance to all Wright buildings (*FLWPOT*) and, hence, *proximity* and *variety effects* simultaneously.

$$FLWPOT_i = \left(\sum_f e^{-\tau D_{if}}\right) \qquad (9)$$

, where τ determines that the spatial decay effect on average across all Wright buildings diminishes with distance. It is estimated using a non-linear least squares estimator (NLS). When used in conjunction with the distance variables mentioned above, a significant impact of the latter will indicate that residents attach particular value to *one* Wright building in proximity as opposed to proximity to several Wright buildings). Ahlfeldt and Maennig (2010c) for historic landmarks in Berlin, which arguably exhibit a generally appealing but not necessarily distinctive architecture, found a strong preference for *variety* but not for a *proximity effect* . Given the uniqueness of the architectural style and the prestige attached to a well known building and its architect, the *proximity effect* could be more important for iconic landmarks.

6. Results

We start the presentation of our results with the basic specifications, which focus on the *proximity effect* discussed above. We assume that Wright buildings are perceived as perfect substitutes and an associated location premium only depends on the proximity of a given property to the nearest Wright building. Table 2 presents our findings. In models (1) and (2) we regress the (log) transaction price per square foot of lot area on the distance to the nearest Wright building and control for internal structural characteristics (except size), location features and time of transaction. We find the (conditional) prices decline, on average, by about 2.9% for each 1 km increase in straight line distance and 1.9% road distance to the nearest Wright building. The difference in the coefficient estimates is perfectly in line with road distances typically exceeding straight lines by about a factor of 1.5 (Ahlfeldt & Maennig, 2009).[3] These results are in line with the hypothesis of a significantly positive amenity effect related to co-location with Wright buildings. While the effect may seem quantitatively small in light of the limited variation in the distance (1km roughly corresponds to a move from the lower to the upper quartile), it is still a (highly) statistically significant impact.

As discussed above, the visual amenity of iconic residential architecture potentially exhibits a very localized impact. Model (5) allows for a more flexible functional form by replacing the continuous distance measure with dummy variables that denote selected distance bands. The resulting pattern points to a significant premium of about 8.2% within 50m, diminishing to about 6% in 50-100m and 5.2% in 100-250m, compared to a control group of properties beyond 1km. Coefficients are not statistically significant for the 250-1000m area. This pattern of results remains relatively stable when adding school district fixed effects and controls for heritage builds, though the 0-50m dummy fails to satisfy conventional significance criteria (4). It does also not change considerably when replacing the dependent variable with residual land prices discussed in the context of the empirical strategy. For further comparison we also replicate the full model with the log of sales price as dependent variable, adding controls of lot size and floor size plus squares of both variables (6). Not surprisingly in light of the bad control problem described in the section above, the coefficients are slightly smaller in the model with potentially endogenous right hand side controls (7% in the 0-50m and 3% in the 100-250m). A surprise, however, is that the 50-100m area treatment coefficient becomes statistically insignificant. A closer look reveals that building densities are significantly increased within this area.[4] One admittedly ambitious

[3] Road distances are calculated using MS Mappoint.
[4] A regression of the floor-space-index (ratio of floor space over lot area) on the same explanatory variables as in model (4) indicates a significant differential within the 50-100m area (about 5%), but in none of the other distance rings.

interpretation could be that some buildings were built or extended to maximize the benefits of the view despite properties not being located immediately adjacent to one another.[5]

In the next step, we turn our attention to the *variety effect* discussed above, precisely on whether, given the *proximity effect* found related to the nearest Wright building, there is any incremental effect of having a larger number of Wright buildings nearby. In model (1) of Table (3), we first add a variable that counts the number of Wright buildings within 250m (*Wright building density*), a threshold based on the Table 2 estimates. We control for the density of listed landmarks with a similarly defined variable (*heritage density*) to disentangle the effects of Wright buildings and landmarks appropriately. The results for this specification provide little support for the existence of a significant *variety effect*. The effect of the Wright building density cannot be rejected from being zero. At the same time, the point estimates on the effects of distance even slightly increase, even though significance levels are reduced.

To allow for a continuous effect of distance in the *variety effect*, we set up a potentiality equation where each Wright building enters the equation with a weight depending on the distance to a given property (see equation 9). We use a non-linear least squares estimator (NLS) to estimate the spatial decay parameter τ. Note that in column (2) we omit other heritage variables to not overload the NLS models. It turns out that the Wright potentiality variable exhibits a positive and significant coefficient. In contrast to the level parameters, however, the decay parameter is not estimated as satisfying statistical precision, which sheds some doubts on the efficiency of the variable to capture the associated Wright building amenity effects. At least, the estimated decay function is plausible as it indicates a localized view effect largely concentrated in the first hundreds of meters around Wright buildings (see Figure 2).

Holding the estimated decay parameters constant and adding heritage variables, including a similarly defined heritage potentiality, as well as the distance to Wright building dummies yields somewhat ambiguous results. On the one hand, the potentiality variable performs well in the sense that it almost entirely picks up effects associated with distance to the nearest Wright building, which is reflected in the distance dummy variable coefficients becoming very close to and statistically undistinguishable from zero. On the other hand, the potentiality variable itself fails to satisfy conventional significance criteria in this specification. This pattern is indicative of a conflict between the distance dummy variable and the potentiality

[5] Another explanation could be that the results are particularly sensitive to altering model specification because of too few observations in the distance band. However, with 84 and (2.5% of the all) observations in the 50-100m ring alone, the area seems reasonably populated.

variable in capturing a similar phenomenon. Given that the potentiality variable also covers proximity to the nearest Wright building, the common theme emerging from a) significant effects of nearest distance variables alone, b) insignificant effects of count variables (pure measure of variety) and c) insignificant effects of potentiality variables when conditioning on nearest building effects, suggests that the effects of iconic (Wright) architecture do not operate primarily through a *variety effect*. Minimally, comparing these results to recent findings in the historic preservation literature (Ahlfeldt & Maennig, 2010c; Lazrak, et al., 2010; Noonan & Krupka, 2011), it seems fair to state that residents put a stronger emphasis on having *one* iconic Wright building in their immediate proximity – presumably within view distance of their property – than on proximity to an arbitrary historic building.

In the last step of the empirical analysis, we address the typical concern in cross-sectional hedonic analyses that the estimated treatment effect could be the result of a spatial correlation in the variable of interest and one or more unobserved location characteristics as – no matter how sophisticated a model is – one can hardly control for all attributes that drive the willingness to pay of the (marginal) buyers. In this specific case, such unobserved location characteristics could have even determined the location of Wright buildings. In an attempt to deal with this problem, we introduce a measure of the historic land value into our specification. We argue that positive location features that were important enough to impact the location of Wright buildings should have been capitalized in land values so that they can be controlled for. One obvious way to respond to the problem, thus, would be to introduce a measure of the value of location that dates back to a period before Wright buildings were built, so to control for unobserved determinants of the location of Wright buildings without confounding the measure with the effects of Wright buildings. To our knowledge, such a measure that would predate the 1890s is not available at a sufficiently fine spatial level. The earliest suitable data we could get hold of were assessed land values as provided in the 1913 edition of Olcott's Land Value Blue Book of Chicago, which was just after all Wright buildings considered in this analysis had been developed. Olcott's land values enjoy a high reputation in the academic literature and have been used in important contributions such as McMillen (1996), although not at a similarly high spatial detail as we propose.[6] A control for 1913 land valuation still adds important insights as it encompasses all relevant location features of that time, including any potential external impact Wright buildings had right after their construction. They allow, thus, for an investigation of whether the "iconic" view effect of Wright buildings identified above is a relatively recent phenomenon, which we presume

[6] Data from "Olcott's Land Values Blue Book of Chicago" has also been used by Bednarz (1975), Berrry (1976), McDonald and Bowman (1979), McDonald (1981), McMillen (1979), McDonald and McMillan (1990), McMillen and McDonald (1991), Mills (1969), and Yates (1965).

given that the reputation of the architect clearly has increased with time and revolutionary architecture may develop a wider appeal with a considerably delay due to slowly adjusting preferences and tastes. If the Wright building premium was already fully priced in by 1913, our extended specification, which effectively corresponds to a long difference in the willingness to pay for land, should not reveal any additional effect of Wright building proximity.

We make use of GIS to merge 1913 land values and contemporary transactions. First, Olcott's land value maps are georeferenced to fit with a geographic coordinate system (decimal degrees). Second, each of the about 1200 land values provided on these maps for the Oak Park study area is assigned to an individual (point) observation. Third, a spatial land value surface is created using an inverse distance weight interpolation technique. Fourth, interpolated land values are assigned to contemporary property transactions, which are identified by geographic coordinates (latitudes / longitudes). The resulting spatial land value surface is illustrated in Figure 3. To allow for a visual comparison, we also create a contemporary land price surface. The contemporary land price proxy comes from a regression of transaction prices per lot area on the hedonic controls listed in Table 1 plus fixed effects for years and census block groups, which are then recovered and interpolated. A correlation with the distribution of Wright buildings is evident from both maps, although high land values are considerably more dispersed in the contemporary surface.

Columns (4-6) of Table 3 show the results for specifications that correspond to the respective columns of Table 2, in each case extended by (log) of 1913 land values. It turns out that neither in our preferred specification (4) nor in the alternative specifications (5-6) do historic land values have a significant impact, conditional on the employed location controls. Moreover, the estimated Wright building proximity effects remain virtually unchanged and even slightly increase in (log) price regressions. These results indicate that the employed location controls are strong and that, as suspected, the iconic design premium emerged over time. It's noteworthy that in unpublished extended specifications we could not find evidence for an increase in the proximity effect during our years of observation, indicating that the adaption of preferences was completed before 2003.[7] Finally we note that our results do not seem to be sensitive to problems of spatial dependency. LM tests do not indicate the presence of spatial specification problems and a robustness test with a spatial error correction

[7] Our tests are based on an extended Table 2, column (1) specification introducing an interaction term of distance to the nearest Wright building and a yearly trend variable. We thank an anonymous referee for this suggestion.

model did not change the pattern of results qualitatively, but even slightly increased the point estimates and the estimation precision.[8]

7. Conclusion

The main aim of this paper is to investigate whether a price premium is achieved for homes near iconic architectural structures. The study adds to a limited body of existing literature on external price effects of architectural design and avoids common challenges faced by this type of study, including how to determine if a certain architecture is perceived as 'good' and how to isolate the architectural element from the use of a building. Oak Park was chosen as the study area given its unique claim of having 24 Frank Lloyd Wright residential structures. The results show that a premium on the price paid per land unit is achieved of up 8.5% for homes within 50m of a Wright home, and about 5% within 50-250m. Beyond this threshold, evidence for positive effects is weak at best. This is significantly less than previous studies have found in terms of the internal price effect of particular architectural styles and design features (up to about 20%, see Asabere, et al., 1989; Moorhouse & Smith, 1994; Vandell & Lane, 1989) and the external price effect of large scale iconic sports facilities (up to about 15%, see Ahlfeldt & Kavetsos, 2011; Ahlfeldt & Maennig, 2010b), but significantly more than the existing evidence for the effect of an additional historic landmark in close vicinity (0.14-2.8%, see Ahlfeldt & Maennig, 2010c; Lazrak, et al., 2010; Leichenko, et al., 2001; Noonan, 2007).

This study utilised a hedonic price model that included several independent variables including various structural characteristics, distance to amenities, proximity to other historic landmark buildings and location in historic districts that served to control for a variety of factors affecting the price of a home. Within this model, the phenomenon of interest, the premium achieved by proximity to a Wright home, could be isolated. Unlike previous studies which suggest that for conventional historic buildings, a higher premium is paid when several landmarks form ensembles, our results provide less evidence for such a complementarily or variety effect for Wright buildings. Indeed, our results suggest that an associated premium paid depends mostly on proximity to the nearest Wright building, which indicates a specific transmission channel. With iconic architecture, even individual buildings seem to exhibit significant externalities, possibly due to their "uniqueness" and, hence,

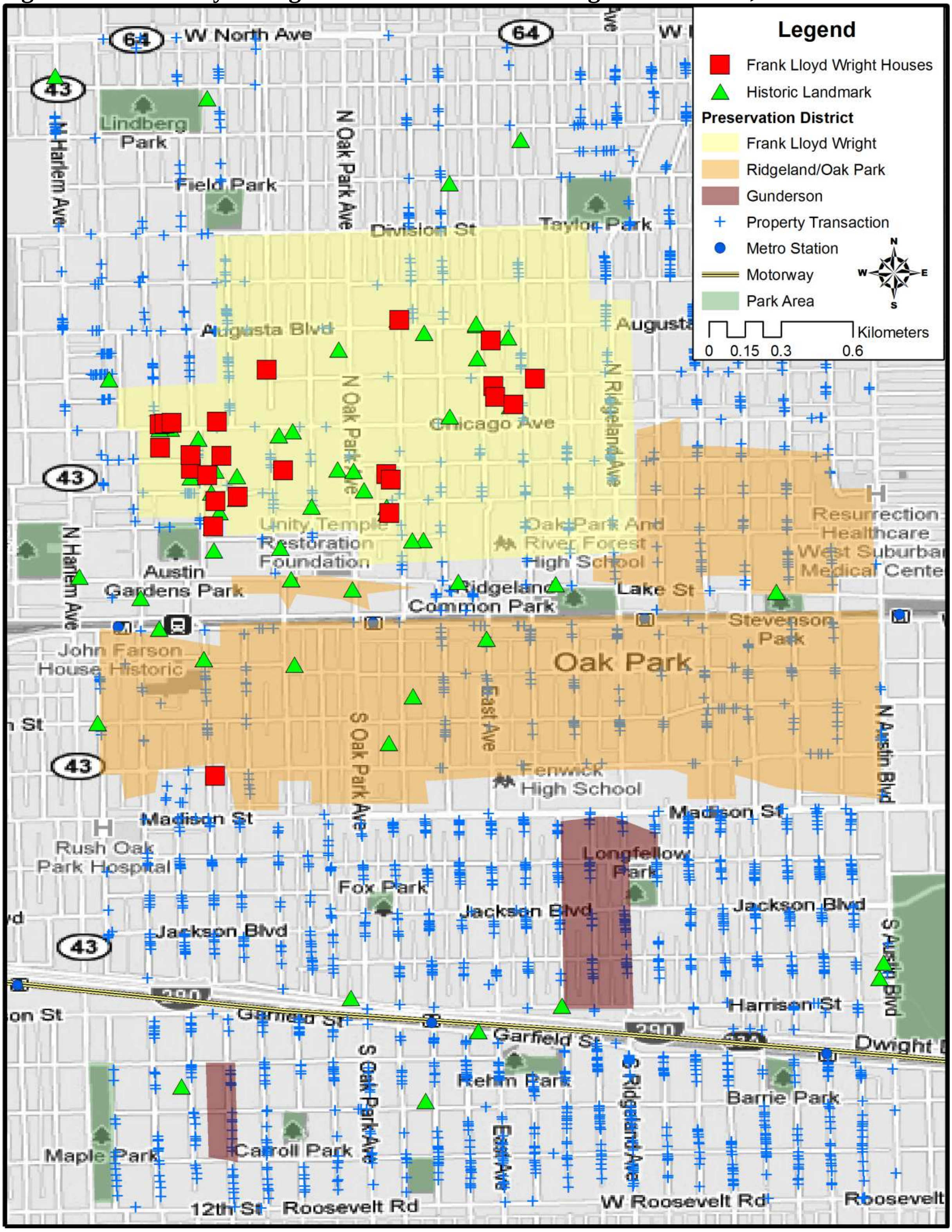
[8] Using a row standardized inverse exponential weights matrix, standard spatial LM test scores do not point to the presence of such problems (see Table 3 notes). Spatial statistics (p-values) from Table2, model (4) are: LMerror: 0.107, Robust LMerror: 0.225, LMlag: 0.254, Robust LMlag: 0.673 +/*/** denote statistical significance at the 10/5/1 percent level. The SEM model we estimated can be written as follows: $y=X\beta+\mu$; $\mu=\lambda W\varepsilon$, where y is the dependent variable, X a vector of independent variables, W a weight matrix, and ε a random error term satisfying the usual conditions.

higher associated visual utility and prestige. Notably, the iconic effect seems to have emerged with delay as historic land values assessed right after the last Wright buildings had been developed in the neighbourhood cannot account for the estimated contemporary premium. This phenomenon may be related to an increase in prominence of the architect over time or a relatively slow adaption of tastes and preferences to innovative architecture.

While the results from this study are interesting, they may not easily generalize to other locations given the uniqueness of Frank Lloyd Wright's architecture and popularity. In this study, it is difficult to separate the prestige element from the actual architectural design and it would be interesting to study the external impact of sophisticated design by lesser-known architects. Still, the existence of significant externalities of iconic architecture opens avenues for conceptionally appealing policies. One could argue that if better architecture were achieved across the board, not only would liveable and enjoyable public spaces be created, but, due to mutual externality effects, homeowners would also benefit from the increased value of their neighbourhoods and eventually their properties. While in this scenario, theoretically, everyone could be made better off, there is, of course, a downside to be considered, requiring that the benefit of such policies be weighed carefully against the cost. Enforcing higher investment into architecture, e.g. by imposing regulatory standards, increases construction costs and potentially discourages (re)development. A rather undesirable result would be a property price increase that is supply rather than demand driven, with potentially negative welfare effects.[9] Clearly, more research is required into the nature of architectural externalities and associated welfare effects before fully informative and reliable policy recommendations can be made.

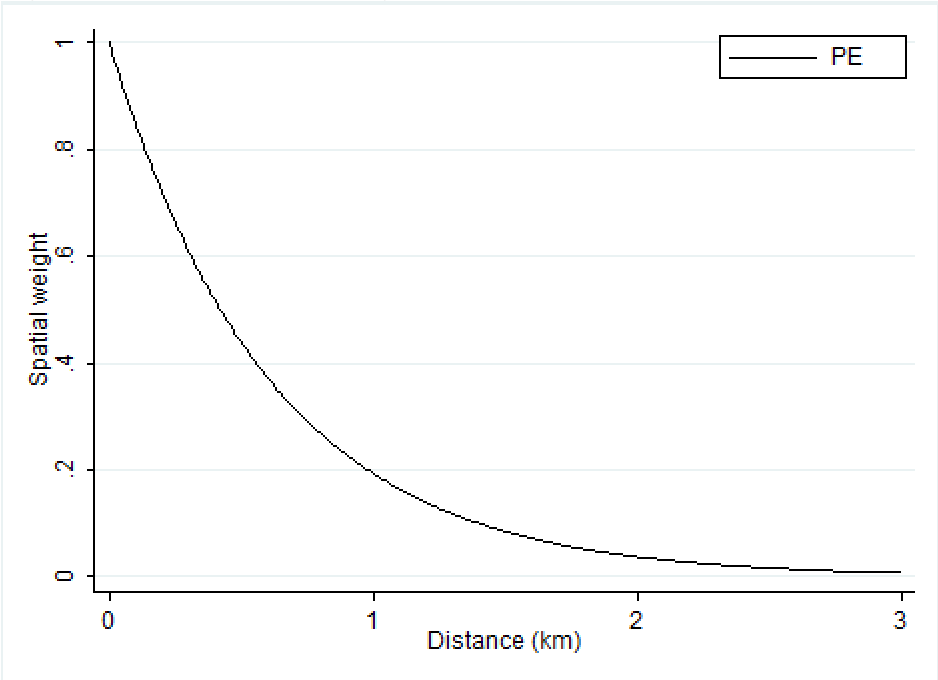
[9] In the model world, this scenario would correspond to an increase in *R*.

Figure 1: Frank Lloyd Wright Houses and Built Heritage in Oak Park, IL



Source: Own illustration. Background map from Google Maps.

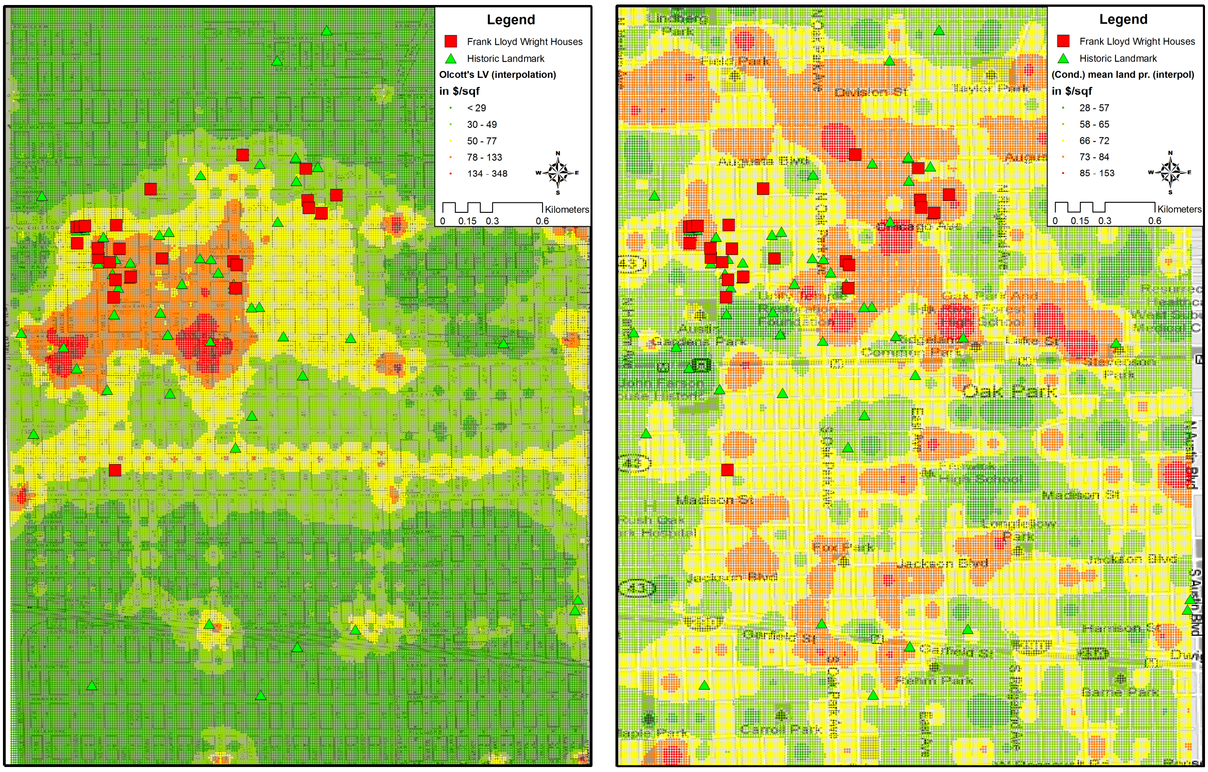
Fig. 2 Spatial decay in Wright potentiality



Notes: Decay function based on Table 3, column (3) model estimate..

Fig. 3 Land Value and Land Price Prices

1913 2000s



Notes: Historic land values are estimates taken from the 1913 edition of Olcott's Land Value Blue Book of Chicago. Current Land Prices are estimated in an auxiliary regression of residential transaction prices per square foot of land area on structural characteristics and census block group fixed effects, which are then retrieved. In both maps, for the purposes of visibility a continuous spatial surface is interpolated using an inverse distance weight interpolation technique.

Tab. 1 Control Variable Description

Lot/floor size	
	Size of lot in square ft
	Size of house in square ft
Hedonic controls	A set of variables capturing the attributes below
	Age in yrs of house
	Number of stories
	Number of bedrooms
	Number of bathrooms
	A (0,1) dummy variable equal to one if house is stand-alone single family
	A (0,1) dummy variable equal to one if building construction material is frame
	A (0,1) dummy variable equal to one if building construction material is masonry
	A (0,1) dummy variable equal to one if building construction material is masonry and frame
	A (0,1) dummy variable equal to one if building construction material is stucco
	A (0,1) dummy variable equal to one if house's basement is a formal recreational room
	A (0,1) dummy variable equal to one if house's basement is an apartment
	A (0,1) dummy variable equal to one if house's basement is unfinished
	A (0,1) dummy variable equal to one if building has an attic
	A (0,1) dummy variable equal to one if house's attic is an apartment
	A (0,1) dummy variable equal to one if house's attic is unfinished
	A (0,1) dummy variable equal to one if house's attic is a living area
	A (0,1) dummy variable equal to one if building has warm air heating
	A (0,1) dummy variable equal to one if building has hot water heating
	A (0,1) dummy variable equal to one if building has electric heating
	A (0,1) dummy variable equal to one if building has no heating
	A (0,1) dummy variable equal to one if building has air-conditioning
	Number of fireplaces
	Number of commercial units in building
	Number of car spaces in garage
	A (0,1) dummy variable equal to one if garage is attached to house
	A (0,1) dummy variable equal to one if garage is under the house
	A (0,1) dummy variable equal to one if house has porch
	A (0,1) dummy variable equal to one if house has been renovated
	Month (1-12) in which a transaction took place
Historic Districts	A set of (0,1) dummy variables denoting following heritage districts: Frank Lloyd Wright-Prairie School of Architecture historic district, Ridgeland-Oak Park historic district and Gunderson historic district (see also Figure 1))
Location Controls	(Road) distance to the nearest highway entrance, (straight line) distance to the highway, distance to the town centre, distance to the nearest subway station, distance to the nearest park
School Districts	A set of (0,1) dummy variables denoting following school districts (average test scores in parentheses): Mann (93.7), Lincoln (89.9), Longfellow (89.7), Beye (88.6), Holmes (87.3), Hatch (85.5), Irving (85.4), Whittier (82.3), Percy Julian (90.3), Gwendolyn Brooks (87.8)
Year Effects	A set of (0,1) dummy variables each denoting a year 2003-2009

Tab. 2 Design effects – basic models

	(1)	(2)	(3)	(4)	(5)	(6)
	log(price/ land area)	log(price/ land area)	log(price/ land area)	log(price/ land area)	log(land value)	log (price)
(min) distance to Wright building (km)	-0.029***	-0.019**				
	(0.008)	(0.009)				
0-50m (min) distance to Wright Building (dummy)			0.082**	0.085	0.081	0.070*
			(0.041)	(0.059)	(0.059)	(0.037)
50-100m (min) distance to Wright Building (dummy)			0.060*	0.051*	0.052*	-0.021
			(0.034)	(0.027)	(0.026)	(0.020)
100-250m (min) distance to Wright Building (dummy)			0.052**	0.051*	0.050*	0.031**
			(0.026)	(0.026)	(0.025)	(0.010)
250-500m (min) distance to Wright Building (dummy)			0.027	0.026	0.024	0.013
			(0.021)	(0.036)	(0.036)	(0.018)
500-1000m (min) distance to Wright Building (dummy)			0.017	0.019	0.017	0.024**
			(0.016)	(0.014)	(0.013)	(0.009)
Distance to Wright building	Straight Line	Road	Straight Line	Straight Line	Straight Line	Straight Line
Year effects	YES	YES	YES	YES	YES	YES
Hedonic Controls	YES	YES	YES	YES	YES	YES
Location controls	YES	YES	YES	YES	YES	YES
School districts	-	-	-	YES	YES	YES
Heritage districts	-	-	-	YES	YES	YES
(min) dist. to landmark	-	-	-	YES	YES	YES
Lot/floor size (squared)	-	-	-	-	-	YES
Observations	3334	3334	3334	3334	3334	3334
R-squared	0.54	0.55	0.55	0.57	0.07	0.65

Notes: Standard errors are robust (white correction) in (1) and (2) and clustered on school districts in (3-6). */**/*** denote statistical significance at the 10/5/1 percent level.

Tab. 3 Design effects – extended models

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	NLS	OLS	OLS	OLS	OLS
	log(price/ land area)	log(price)	log(price/ land area)	log(price/ land area)	log(land value)	log(price)
(min) distance to Wright	0.1		0.013	0.083	0.084	0.080*
Building 0-50m (dummy)	(0.08)		(0.073)	(0.056)	(0.052)	(0.033)
(min) distance to Wright	0.08		-0.009	0.051*	0.053**	-0.015
Building 50-100m (dummy)	(0.048)		(0.053)	(0.022)	(0.022)	(0.018)
(min) distance to Wright	0.062*		0.02	0.050*	0.051*	0.034**
Building 100-250m (dummy)	(0.03)		(0.042)	(0.024)	(0.022)	(0.01)
(min) distance to Wright	0.024		0.008	0.023	0.026	0.018
Building 250-500m (dummy)	(0.037)		(0.061)	(0.038)	(0.034)	(0.018)
(min) distance to Wright	0.02		0.012	0.015	0.017	0.022*
Building 500-1000m (dummy)	(0.014)		(0.02)	(0.017)	(0.013)	(0.009)
Wright building density	-0.011					
(Count within 250m)	(0.007)					
Wright potentiality		0.007**	0.003			
(*FLWPOT*)		(0.002)	(0.009)			
Decay parameter		1.646				
(τ)		(1.473)				
(log) Land value 1913				-0.002	-0.004	-0.018
				(0.015)	(0.014)	(0.01)
Year Effects	YES	YES	YES	YES	-	YES
Hedonic controls	YES	YES	YES	YES	-	YES
Location controls	YES	YES	YES	YES	YES	YES
School Districts	YES	YES	YES	YES	YES	YES
Heritage Density	YES	-	-	-	-	-
Heritage District	YES	-	YES	YES	YES	YES
(min) dist. to landmark	YES	-	YES	YES	YES	-
Heritage potential	-	-	YES	-	-	YES
Lot/floor size (squared)	-	-	-	-	-	YES
Observations	3334	3334	3334	3334	3334	3334
R-squared	0.57	0.57	0.57	0.57	0.07	0.65

Notes: Heritage density and potentiality is defined analogically to Wright building density and Wright potentiality using all listed landmarks. Standard errors are clustered on school districts in all models. Standard errors in (2) are from OLS regressions holding the previously decay parameter estimated by means of NLS constant. */**/*** denote statistical significance at the 10/5/1 percent level.

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