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Open space amenities: Is closer better?

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Open Space Amenities: Is Closer Better?

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Anna Temel, Patrick Thiel, and Colin Vance*

Open Space Amenities: Is Closer Better?

Abstract

The value of open space is often reflected by the higher prices of the homes located in its proximity. But is closer always better? We examine this question by estimating a hedonic regression using pooled cross-sectional data from Germany spanning 2007 until 2023. We distinguish two types of open space, parks and protected areas (PAs), and explore heterogeneity in the effects of the latter according to prevailing environmental attitudes, as measured by the share of the Green party vote. Results suggests that increasing distance to parks substantially decreases home prices, with the magnitude of the effect weakening as distance increases. Increasing distance to PAs likewise decreases home prices, but the effect is smaller and hardly varies by distance. More strikingly, we find a negative effect of PAs on prices for homes located within their boundaries, with no evidence that this effect is mediated by the share of Green voters. One possible explanation is that the restrictions that often accompany PAs may offset their amenity value, irrespective of local political support for conservation, a reaction that planners would be wise to anticipate in siting decisions.

JEL-Codes: R30, R58, H41, Q51

Keywords: Open space; house values; hedonic price framework; valuation

October 2024

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1 Introduction

Open space – broadly defined as “an undeveloped area within a designated development zone” as outlined in § 9 Abs. 1 Nr. 10 of the German Building Code (BauGB) – is seen as serving a wide range of functions, including habitat protection, the preservation of ecosystem services, and recreation. While homebuyers are drawn to the natural amenities afforded by open space (Radeloff et al., 2010), efforts to target particular sites for development restrictions often meets resistance from local homeowners. In Germany, such resistance has long vexed policy planners (Georgiev et al., 2021; Lindenmayer et al., 2018; Stoll-Kleemann, 2001), leading to conflicts such as recently seen in the county of Enzkreis, where a fracas has erupted among residents over the conversion of mixed cropland and trees to a housing development (Ispringen, 2024). These opposing tendencies — the coveting of open space on the one hand contrasted by protests against its preservation on the other – raises the question of what circumstances determine the value of open space to the people who live in its proximity.

The present paper takes up this question by exploring two types of open space: parks and protected areas (PAs). Using data on real estate advertisements that cover large parts of the German housing market spanning the period from 2007-2023, we estimate hedonic regression models that quantify the effects of proximity to the boundaries of parks and PAs on asking prices for homes. Our aim is twofold. First, we quantify to what extent, if any, differences in how people value parks and PAs are reflected in different asking prices for homes on the local real estate market. Second, we explore the cross-cutting role of prevailing environmental attitudes – measured by the share of votes in the preceding election going to the Green party – in conditioning the effect of proximity to open space on asking prices.

Our work thereby contributes to research that quantifies the value of natural amenities using the hedonic regression model, the coefficients from which can be interpreted to measure the marginal willingness to pay for an amenity (Rosen, 1974). Many such studies focus on parsing out the effects of different categories of open space (Espey & Owusu-Edusei, 2001). An early example is Geoghegan’s (2002) analysis of “permanent” versus “developable” open space in a fast developing region on the periphery of Washington D.C., where she finds the positive effect of the former on house prices to be three times the magnitude of the latter. Subsequent work has largely focused on distinguishing the effects of open space according to its biophysical attributes (Bark et al., 2011; Melichar & Kaprová, 2013). Panduro and Veie (2013), for example, distinguish eight types of green space and estimate their effects on home prices in the city of Aalborg, finding extensive heterogeneity that includes both positive and negative effects depending in part

on the type of adjacent land use. Gibbons et al. (2014) examine the effect of a large variety of natural amenities, from habitats to domestic gardens, on property prices in England, finding uniformly positive effects. Their study – one of the few to cover a broad geographic region – generally aligns with many other studies that focus on more narrow geographic locations, which reveal substantial value attached to a number of habitats and environmental amenities (Bark et al., 2011; Czembrowski & Kronenberg, 2016).

Our work extends on this body of research in two respects. First, similar to Geoghegan (2002), we partition open space into two categories based not on biophysical attributes but rather on tenure, focusing specifically on parks and protected areas (PAs). Although both tenures support various ecosystem services, the key functionality distinguishing them is that parks primarily serve to provide space for humans to recreate. The key functionality of PAs, by contrast, is conservation, though some degree of human activity may be permitted within the PA’s boundaries, raising the possibility for conflict with its conservation objectives.

Along the lines of this tenure-based delineation of open space, the second extension is to explore the extent to which prevailing support for environmental causes conditions the impact of parks and PAs on home prices. We measure such support by the local share of the vote won by the Green party in the preceding election. Since its founding in 1980, the establishment of terrestrial protected area has been a key priority of the Greens, evidenced by the consistent and extensive coverage of the issue in the party’s platform (Bündnis 90 / Die Grünen, 2021; Die Grünen, 1980). It is therefore plausible that a high share of Green voters in a given locality corresponds to a high willingness-to-pay for natural amenities in that locality, which in turn would be expected to increase prices of affected homes. To allow for this possibility, we interact the Green vote share with dummies indicating proximity to- or location within a PA.

Among our key results, we find that increasing distance to a park is associated with significantly lower house prices, an effect that approaches zero up to a distance of about eight kilometers. By contrast, distance to the PA has only a weakly discernible effect on house prices, the exception being when the house is located within the PA itself. In this case, the effect is negative, decreasing the price by about 5%. The preponderance of votes for the Green party has no bearing on this result.

The following section of the paper describes the data assembly, presents descriptive statistics, and the empirical approach. Section 3 presents the results, while Section 4 concludes.

2 Data and Empirical Strategy

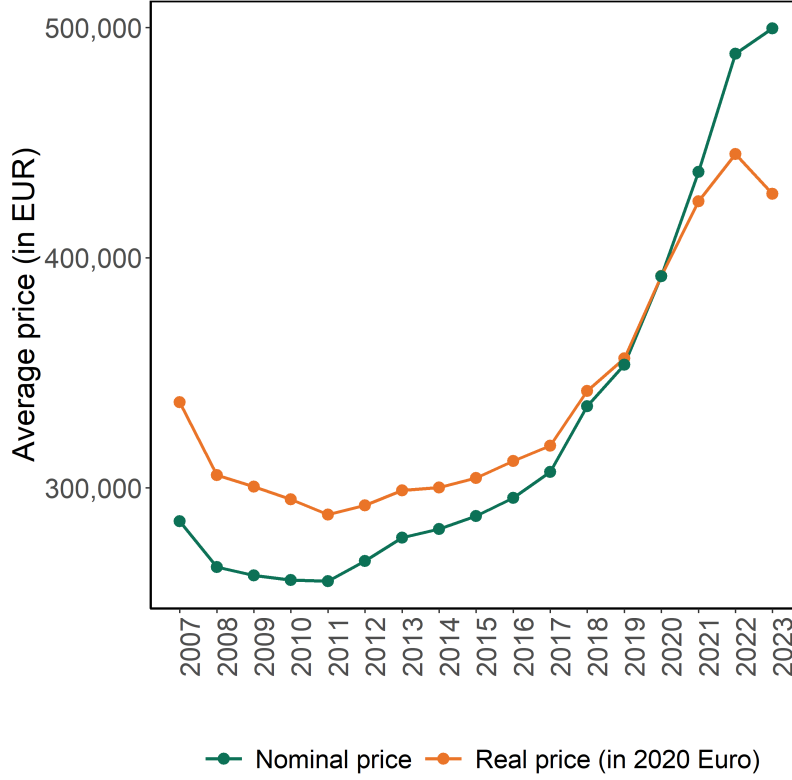
2.1 Data

Our empirical analysis draws on several georeferenced data sets, one covering house prices and the others covering parks and PAs. These are merged using the GIS-toolbox in R. The data on house prices is obtained from the RWI-GEO-RED repository, which comprises listings from residential offers provided by the website ImmobilienScout24.de (RWI - Leibniz Institute for Economic Research, 2023), Germany’s largest online portal for real estate postings. The data contains the asking prices and characteristics of homes and apartments, including their geocoordinates, for the period spanning 2007 to 2023 (Schaffner & Thiel, 2024). In our analysis, we solely focus on house sales, as we expect open space amenities to be more relevant for these transactions than for rentals.

The use of asking prices raises the question of whether they are a good substitute for transaction prices. Dinkel and Kurzrock (2012) explore this question using data from rural areas of Germany. They compare the asking price advertised on ImmobilienScout24 with the actual transaction price, finding a differential of about 15%. Subsequent studies have used the data to analyze developments in Germany’s real estate market, such as Bauer et al.’s (2017) analysis of nuclear plant closures following the Fukushima disaster. In a subsequent analysis of home energy performance, Frondel et al. (2020) compare ImmobilienScout24 data with transaction prices from Berlin and find a difference of about 7%, that remains stable over time. Taken together, the evidence suggests that asking prices, while not ideal, are a reasonable proxy for transaction prices in the German real estate market.

Figure 1 shows the mean asking prices for houses in Germany expressed in nominal and real values, with the latter series deflated by the monthly price indices provided by the Federal Statistical Office (Federal Statistical Office (Destatis), 2024). The data commences in 2007, just prior to the start of the global financial crisis in 2008. House prices reach a trough by 2011, after which they climb steadily upward. Consistent with the housing price index published by the FRED (2024), by 2022 real house prices had increased by some 50% since 2011. We capture these temporal developments in house prices by including month-year dummies in the econometric specification.

Figure 1: Average House Prices Over Time



Notes: The figure shows the average house price measured as real prices (in 2020 Euro) and nominal prices (in Euro).

Source: Authors' graph.

Three key explanatory variables are of interest: the Euclidean distance separating the house from the nearest boundary to a PA or to a park, and a dummy variable indicating whether the house is located within the boundaries of a PA. Following the definition of OpenStreetMap, parks are open space areas designated for recreational use by the general public that are comprised of grassy areas with trees and bushes, whose borders are subsumed within their hosting city or town. By contrast, following the International Union for the Conservation of Nature (IUCN), PAs are open space areas established for the primary purpose of biodiversity conservation. They are typically larger than parks, having boundaries that may extend across several municipalities. Some amount of human activity may be permitted within the PA, including tourism, logging, and residential development. Indeed, about 6% of the homes for sale in our data are located within the boundaries of a PA, a circumstance we capture with a dummy variable. No such multiple-purpose use pertains to parks. Although parks may serve as a haven for biodiversity (Palliwoda et al., 2017), their main use is for recreation.

The borders of PAs are drawn from various sources, the main one being the database

of Nationally Designated Areas (CDDA) from the European Environment Agency (EEA) (European Environment Agency, 2021). This data contains the geographical delineations of protected areas of the 38 European member countries, and is integrated with the Natura2000 database provided by the EEA (European Environment Agency, 2019).

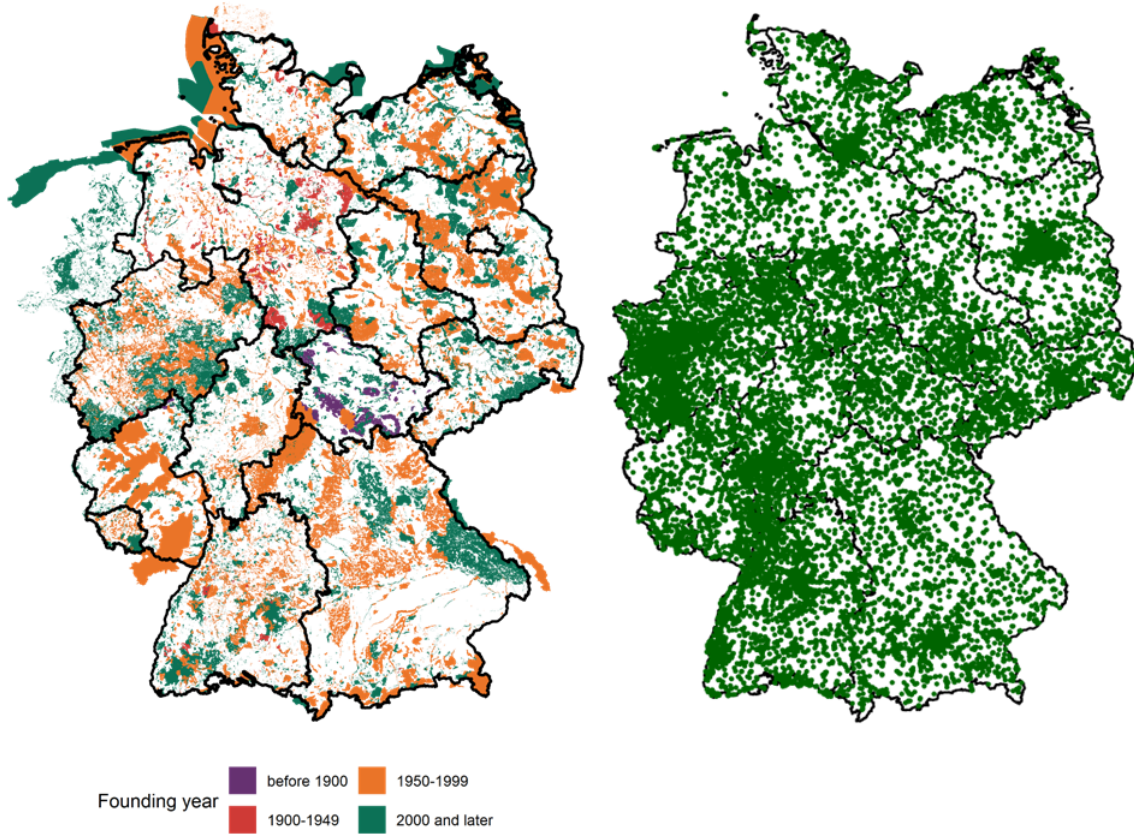
Natura2000 encompasses additional areas under the Birds Directive (2009/147/EC) and the Habitats Directive (92/73/EEC) and covers the entire European Union. We augment these data with a layer from Germany’s Federal Agency for Nature Conservation (Federal Agency for Nature Conservation, 2021). All data sources additionally contain the foundation year of the PA, so that our derived spatial measures correspond to the year that the house is observed. Our final database includes approximately 23,000 PAs in Germany with an average (median) size of 14 (1.3) km². The regional distribution and historical evolution of PAs are shown in the left panel of Figure 2, depicting that large areas of Germany – currently about 19% of terrestrial land – are covered by PAs.

To measure the proximity of the house to the boundary of the nearest park, we use data from Open Street Map (OSM) stored under the tag “leisure=park”. As of the year 2022, the data records a total of about 37,000 parks in Germany, the location of which are plotted in the right panel of Figure 2. The plotted points indicate the centroids of the park boundaries, which have an average (median) size of 0.016 (0.004) km².¹ Information on the establishment dates of the parks is not available. Our measurement of distance to the park consequently assumes that the park was already in existence as of the first year of the data in 2007. While it is not possible to formally test this assumption, it seems reasonable based on an ad hoc review of municipalities that provide online historical information on their parks. The listings provided by the cities of Essen and Berlin, for example, include no parks that were established after 1990.²

¹This designation thus excludes *National Parks*, which are recorded in the data on PAs.

²See: <https://www.visitberlin.de/en/parks-gardens> and https://www.essen.de/dasistessen/leben_im_gruenen_/parks_und_gruenflaechen/parks_und_gruenflaechen.de.html.

Figure 2: Protected Areas and Parks in Germany



Notes: The figure shows the geographical distribution of protected areas (left panel) and parks (right panel).

Source: Authors' graph.

Table 1 presents the descriptive statistics of the dependent- and explanatory variables included in the econometric model. Commensurate with other research demonstrating the importance of different landscape features on house prices (Brander & Koetse, 2011; Hu et al., 2022; Panduro & Veie, 2013), these include a suite of proximity measures to amenities other than parks and PAs, including the distance to gardens, lakes, rivers and the city center. They also include characteristics of the house itself (e.g. number of rooms, condition, etc) as well as regional descriptors of income level and the vote share for the Green party in the preceding election.

Table 1: Summary Statistics of Houses

	Mean	Std. Dev	Variable Format
A. Housing Characteristics			
log(house price)	12.52	0.63	Continuous
Real house price (in EUR)	333,548.86	230,760.73	Continuous
Age	48.42	33.94	Continuous
Number of floors	1.56	0.76	Continuous
Endowment	2.26	0.51	Categorical
Number of bathrooms	1.47	0.84	Continuous
Plot size (in sq. meter)	697.01	487.23	Continuous
Heating type	11.95	2.58	Categorical
Under construction	0.01	0.08	Binary
Condition	5.67	2.38	Categorical
Post PA	0.95	0.21	Binary
Living space (in sq. meter)	167.91	74.75	Continuous
Number of rooms	5.91	2.61	Continuous
B. Proximity Variables			
Within 1km of PA	0.71	0.46	Binary
Within PA	0.06	0.24	Binary
Dist. to canal (in km)	18.07	14.3	Continuous
Dist. to city center (in km)	2.06	1.63	Continuous
Dist. to garden (in km)	2.5	2.37	Continuous
Dist. to lake (in km)	5.24	3.66	Continuous
Dist. to PA (in km)	0.73	0.95	Continuous
Dist. to park (in km)	1.41	1.62	Continuous
Dist. to river (in km)	5.59	5.09	Continuous
Dist. to stream (in km)	22.12	14.93	Continuous
C. Other Variables			
Purchasing power per capita (in EUR)	22,482.27	4,174.9	Continuous
Green party vote share	8.93	4.09	Continuous

Notes: The table lists summary statistics for the included variables. Endowment ranges from simple to deluxe, allowing for four categories in total. Heating describes the power source and includes types like electric heating and gas or oil heating. 13 categories are available in the data set. The condition of the house can vary from first occupancy to dilapidated. The variable combines ten categories. More details are listed in Schaffner and Thiel (2024). The variables “purchasing power” and “green party vote” are measured at the municipal level, rather than at the individual household level. The variable “PostPA” is a binary variable that indicates whether the house in question was listed after the establishment of the nearest protected area (PA).

Source: Authors’ table.

2.2 Empirical Strategy

Parks and PAs are not distributed randomly across the landscape. Rather, their siting is correlated with any number of factors that may also bear on home prices. Our point of

departure consequently employs a hedonic regression specified to mitigate the endogeneity bias that otherwise emerges from the challenge of controlling for all of these factors. Estimated using ordinary least squares, the baseline specifications reads:

$$\begin{aligned} \log(p) = & \theta_1 \text{DistPA} + \theta_2 \text{DistPA}^2 + \lambda_1 \text{DistPark} + \lambda_2 \text{DistPark}^2 + \\ & \gamma_1 \text{WithinPA} + \mu \text{Post} + \gamma_2 \text{WithinPA} \times \text{Post} + X' \beta + \tau + \alpha + \epsilon, \end{aligned} \quad (1)$$

where $\log(p)$ denotes the logged listing price of a house. *DistPA* and *DistPark* measure the distance to the nearest PA and park, both of which additionally include their squared terms to allow for nonlinear effects. The dummy variable *WithinPA* indicates that the house is located within the boundaries of a PA, irrespective of when the PA was established, while the dummy *Post* indicates that the price listing is observed after the PA's establishment. The product *WithinPA* \times *Post* designates the interaction of the two dummies. *X* is a vector containing the remaining control variables, listed in Table 1. The model is completed with regional fixed effects, τ , measured by dummies for each 5 x 5 km grid cell, and time fixed effects, α , measured at the year-month level. ϵ is a normally distributed error term, while θ , γ , μ , λ and β are parameters to be estimated.

The quadratic specification of the distance variables in Model 1 affords a flexible way to compare how the influence of proximity to parks and PAs on house prices varies over the spatial gradient. Identification is based on continuous variation in these measures. Taking advantage of the available information on the establishment date of the PA, we also estimate a second model in which we replace the variables *DistPA* and *DistPA*² with a specification like that used to measure the effect of location within the PA. Specifically, we define a dummy variable, *PA1km*, which equals one for houses located outside a PA but within one kilometer of its border, again irrespective of the PA's establishment date.³ This dummy is multiplied by *Post*, yielding:

$$\begin{aligned} \log(p) = & \theta_1 \text{PA1km} + \theta_2 \text{PA1km} \times \text{Post} + \lambda_1 \text{DistPark} + \lambda_2 \text{DistPark}^2 + \\ & \gamma_1 \text{WithinPA} + \mu \text{Post} + \gamma_2 \text{WithinPA} \times \text{Post} + X' \beta + \tau + \alpha + \epsilon, \end{aligned} \quad (2)$$

The incorporation of proximity-to-PA as a binary treatment variable above, coupled with the availability of houses that are observed before and after the establishment of the PA, allows us to more forcefully isolate the effect of proximity on the house price. The coefficient θ_2 is akin to a difference-in-differences estimate, capturing differences in the pre- to post periods in the average price of houses located within one kilometer of and

³The one-kilometer distance seems reasonable to capture proximity but is, of course, arbitrary. We consequently undertake robustness checks, referenced below, that set shorter and larger distances.

further away from a PA, conditional on the control variables.⁴ The same interpretation applies to γ_2 , in this case capturing differences in the pre- to post periods in the average price of houses located within and outside of the PA. A key assumption underpinning both interpretations is parallel trends: Conditional on the controls, we assume that the prices of treated and untreated houses would have followed the same trend in the absence of the PA’s establishment. This assumption receives further scrutiny below using event-study approaches.

The final model explores heterogeneity according to the share of Green votes in the preceding election in the municipality in which the house is located. We focus this question exclusively on PAs given the controversy that has often accompanied their establishment. To this end, we expand on Model (2) by introducing terms that interact the Green voter share from the preceding election with the dummies indicating location within and nearby to a PA.

3 Results

Table 2 presents select coefficient estimates and their standard errors, the latter clustered at the municipality level. The full set of estimates from each model is presented in the appendix.

We turn first to the estimate of distance to park and its square in Model (1), both of which are statistically significant at the 1% level. Taken together, the estimates suggest a convex relationship: As the distance to the park increases, the house price falls but at a decreasing rate. The magnitude of the negative effect bottoms out at zero, when distance reaches about eight kilometers. By contrast, little evidence for such a nonlinearity is seen in the estimate of distance to a PA; the estimate of the variable itself is considerably smaller than that of distance to park, and the estimate of its squared term is statistically insignificant. The price differential of a house directly adjacent to a park compared to a house 500 meters away is about an additional 3,900 euros. The corresponding price differential for a PA is just a fraction of that amount, at about 680 euros.

Further insight into these results can be gleaned from Figure 3, which shows predicted list prices at varying distances to parks and PAs, evaluated at the mean of the other explanatory variables. The initial downward slope of the parks-curve is steeper and has a more pronounced curvature. Both curves flatten out at about eight kilometers, beyond

⁴We say “akin to” in acknowledgment of our use of pooled-cross-sectional data rather than panel data. The classical application of difference-in-differences estimated with panel data controls for all time-invariant unobservable variables. Our approach imposes the assumption that relevant time-invariant unobservables are captured in the vector X .

which only a small share of houses – less than 0.01% – are situated. Returning to the question posed in the title, the figure conveys that in the case of parks, closer is indeed better. The same holds true for PAs, but to a much weaker degree. Indeed, the price of a house located directly adjacent to a PA and one located four kilometers away is statistically indistinguishable, as evidenced by the overlapping 95% confidence intervals.

What about location within the PA itself? The coefficient estimate of the treatment effect is -0.05 and highly significant, suggesting that the establishment of the PA decreases prices of houses located within the PA by some 5% relative to houses outside the PA.⁵ This conclusion continues to hold in Model 2, where we use a difference-in-differences setup to capture the situation for houses located outside of but within one kilometer of a PA. After the establishment of the PA, these houses experience a less than 1% bump in the house price that is statistically indistinguishable from zero, while houses within the PA continue to experience about a 5% decrease in the price, corroborating Model 1. We explored two other variants of Model 2, not presented, in which the proximity to PA dummy was set at 500 meters and at 1.5 kilometers; the estimated effect remains at about 1% and fails to reach statistical significance at the 5% level.

⁵Given the logged dependent variable, the precise estimate equals $100 \cdot (\text{EXP}(-0.0507) - 1)$, or about -4.94%.

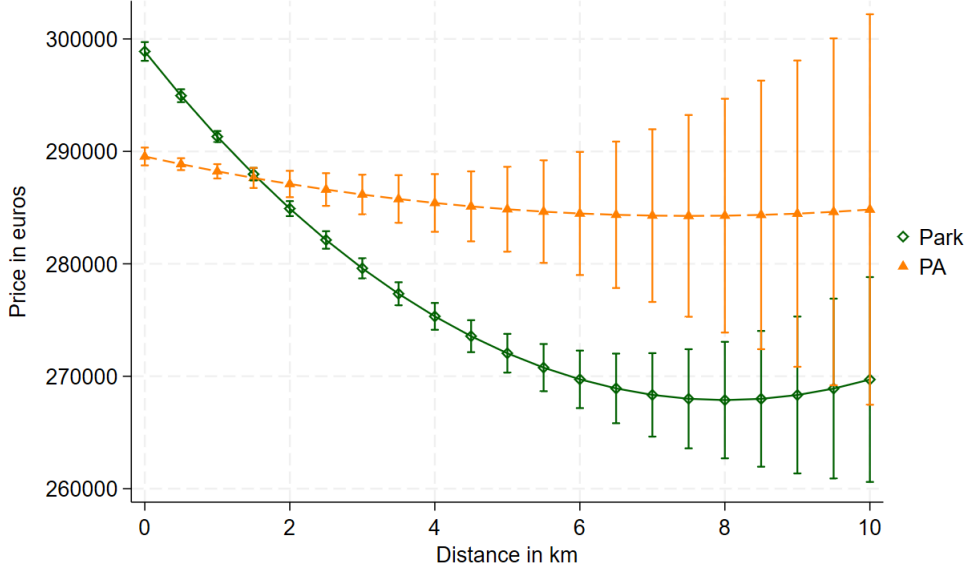
Table 2: Baseline Results, Proximity Model, and Results Regarding Green Party Votes

Dependent Variable:	log(house price)		
	Baseline Results	Proximity Model	Green Party Votes
	(1)	(2)	(3)
Dist. to PA	-0.0049** (0.0022)		
Dist. to PA ²	0.0003 (0.0005)		
Dist. to park	-0.0274*** (0.0016)	-0.0273*** (0.0016)	-0.0273*** (0.0016)
Dist to park ²	0.0017*** (0.0003)	0.0017*** (0.0003)	0.0017*** (0.0003)
Within PA	0.0058 (0.0151)	0.0150 (0.0169)	0.0186 (0.0354)
Within 1km to PA		0.0090 (0.0077)	0.0221 (0.0201)
Post PA	0.0058* (0.0034)	0.0069 (0.0071)	-0.0686*** (0.0184)
Within PA \times Post PA	-0.0507*** (0.0155)	-0.0500*** (0.0172)	-0.0704* (0.0361)
Within 1km to PA \times Post PA		0.0000 (0.0076)	-0.0143 (0.0200)
Green party vote	0.0050*** (0.0005)	0.0050*** (0.0005)	-0.0036* (0.0019)
Green party vote \times Within PA			0.0013 (0.0038)
Green party vote \times Within 1km to PA			-0.0009 (0.0020)
Green party vote \times Post PA			0.0087*** (0.0018)
Green party vote \times Post PA \times Within PA			0.0007 (0.0038)
Green party vote \times Post PA \times Within 1km to PA			0.0010 (0.0020)
Fixed-effects			
Year-Month FE	✓	✓	✓
5km Grid FE	✓	✓	✓
Fit statistics			
Observations	8,314,932	8,314,932	8,314,932
R ²	0.72566	0.72567	0.72578
Within R ²	0.47099	0.47101	0.47121

Notes: The table presents the abbreviated regression output of the baseline model, the proximity model, which emphasizes the within 1 km to PA dummy, and the Green Party vote model, which specifies interactions with the Green Party vote share. The full regression output is shown in Table A1 in the appendix. Clustered standard errors at zip-code level are in parentheses. ***, **, and * denote statistical significance at 1%, 5% and 10%.

Source: Authors' table.

Figure 3: Predicted House Prices from Model 1



Notes: The vertical bars indicate the 95% confidence intervals.

Source: Authors' graph.

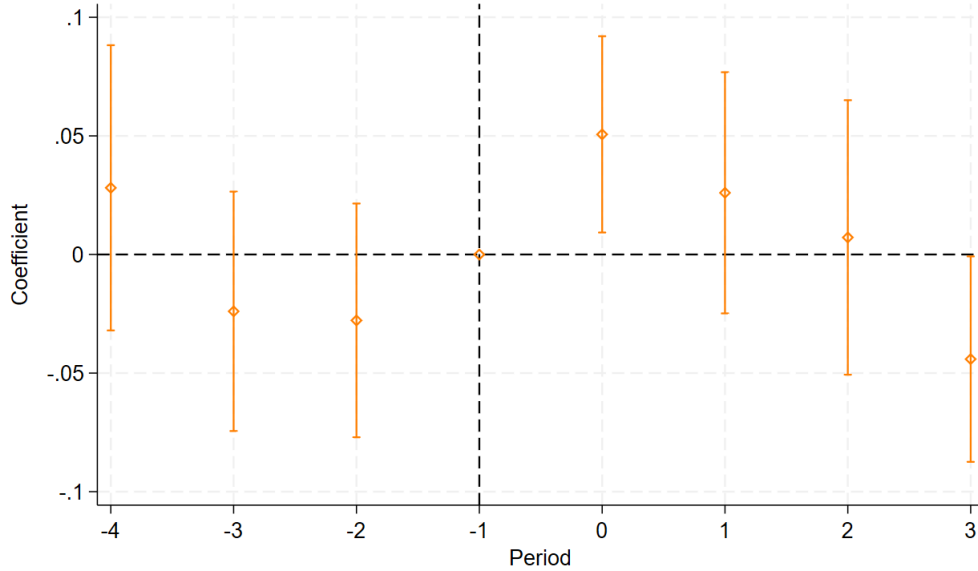
To explore the assumption of parallel trends required for causal interpretation of the treatment effects, we estimate an event study model that allows for differential trends by year before and after the establishment of the PA for houses within and close to the PA boundaries. We presents results from a model with four leads and three lags, specified as:

$$\begin{aligned} \log(p) = & \lambda_1 \text{DistPark} + \lambda_2 \text{DistPark}^2 + \mu \text{Post} + \theta \text{PA1km} + \sum_{t=-4}^3 \theta_t (\text{Year}_t \times \text{PA1km}) + \\ & \gamma \text{WithinPA} + \sum_{t=-4}^3 \gamma_t (\text{WithinPA} \times \text{Year}_t) + X' \beta + \tau + \alpha + \epsilon, \end{aligned} \quad (3)$$

Figure 4 presents the estimates of γ_t corresponding to the within-PA treatment. The estimates on the dummies indicating the periods prior to the establishment of the PA are uniformly statistically insignificant, providing some support for the parallel trends assumption. The estimates on the post-establishment dummies, however, present a more nuanced picture than Model 2. Specifically, we find evidence for an initially positive effect in the first year after treatment, but one that decreases steadily in subsequent years. By the third year and beyond, the effect is roughly -4.5%, corroborating the simpler specification of Model 2. While the reason for this shift in signs is not immediately clear, it may partially reflect the net outcome of the countervailing forces that attend and follow PA-establishment. As discussed by Ahlfeldt et al. (2017), although PAs may provide

benefits to local homeowners by reducing uncertainty regarding the future of their area, the restrictions they entail may ultimately impose a cost by limiting the degree to which properties can be altered.⁶ This latter effect is presumably reflected by the negative and significant coefficient of the final lagged variable, a result we find is robust to the inclusion of additional and fewer lags (not presented).

Figure 4: Event Study Plot: Within PA



Notes: The vertical bars indicate the 95% confidence intervals.

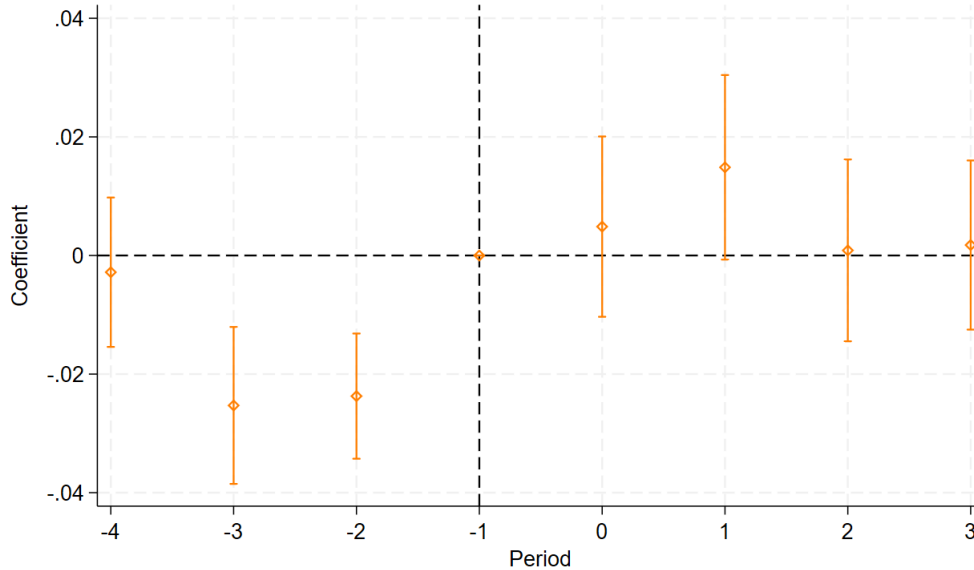
Source: Authors' graph.

Figure 5 presents the event study plot corresponding to the treatment of a PA being established within one kilometer of the house. In this case, the statistically significant pre-treatment estimates suggests that treated and untreated households were already on different trajectories prior to the establishment of the PA, suggesting a potential violation of the parallel trends assumption. Households near the PA see a dip of about 2.5% in the years preceding treatment, while the post-treatment period sees weakly positive and statistically insignificant effects. One possible explanation for the initial price decline may relate to the disruption and contentious circumstances that sometimes precedes PA-

⁶For example, the German Federal Nature Conservation Act (BNatSchG) permits the utilization and development of areas within protected zones, provided that individual conservation efforts within these areas are not negatively affected. Existing land uses, such as hunting rights and forestry, can be allowed to continue. However, the law enforces strict restrictions on new construction and activities.

establishment, including in some cases protests among opposing interests.⁷ Although not supporting parallel trends, the pattern in Figure 5 yields no evidence altering our base conclusion that closeness to the PA does not substantially increase the house price.

Figure 5: Event Study Plot: PA-border Within 1 KM



Notes: The vertical bars indicate the 95% confidence intervals.

Source: Authors' graph.

The final model in Table 2 turns to the question of whether the share of Green party voters from the preceding election bears upon the estimated effect of PAs on house prices. To the extent that voting outcomes in favor of the Greens reflect, at least in part, preferences for environmental amenities, it is conceivable that such preferences are reflected by higher prices among houses in proximity of PAs. The estimates presented in Table 2 provide no support for this conjecture. An increasing share of Green votes mediates neither the effect of PAs on the prices of houses located with their boundaries nor within one kilometer of proximity. This could be interpreted to mean that prevailing environmental preferences are not manifested via the hedonic price function, perhaps owing to other counteracting forces like a 'Not in My Back Yard'(NIMBY)-effect. But we also cannot rule out the possibility that our measure of the Green vote share is poorly suited to pick up an effect of such preferences even if it existed. The average value of the share is about 9%, with less than 0.5% of observations having a share greater than 25%, pointing to

⁷For example, environmental activists established a protest camp with the objective of opposing the deforestation of the Leinemasch Nature Reserve, situated in the vicinity of Hannover (taz, 2023). Meanwhile, in Upper Swabia, landowners engaged in a demonstration to express their discontent with the limitations imposed on the economic utilization of their land as a consequence of the establishment of a new biosphere reserve (Süddeutsche Zeitung, 2024).

potentially insufficient variation.

4 Conclusion

Using comprehensive real estate data covering all of Germany from 2007-2023, this paper has estimated the effect of proximity to parks and protected areas (PAs) on the asking prices of houses. We explore alternative econometric models using both continuous measures of distance and, in the case of PAs, dummy variables that allow us to take advantage of available information on the PA's establishment date, thereby supporting a specification similar to that of difference-in-differences but using pooled data. Recognizing that both parks and PAs proffer open space amenities, our aim was to isolate whether the underlying purposes of these two tenure forms – in the case of parks, recreation, and in the cases of PAs, conservation – bear differently on house prices.

Several results emerge. First, we find that distance to parks has a statistically significant and large negative effect on house prices, one whose magnitude decreases over the spatial gradient. Based on the model predictions, we find that a house located two kilometers from a park is, on average, about 6,000 euros cheaper than a house located one kilometer from a park, while there is virtually no difference in the prices of houses located seven and eight kilometers from a park. The distance to a PA likewise has a negative effect on house prices, but the magnitude is much weaker and there is no evidence for a nonlinearity. When specifying the treatment as a dummy variable, we find no difference between the prices of houses located within one kilometer of a PA and those located further away. Perhaps most strikingly, we find that a negative effect emerges for houses situated within the boundaries of a PA, reducing the price by about 5%. While we conjectured that this negative effect might be mitigated by an increasing share of voters for the Green party in the surrounding municipality, no evidence emerged to support this.

We interpret these results to conclude that people value open space amenities primarily insofar as they support recreational opportunities. While there may be some additional intrinsic value that people ascribe to open space, this is likely to be offset by the restrictions that necessarily accompany its establishment when the main objective is conservation. From an equity perspective, planners should take into account these opposing forces. Our results suggest that when designating PAs, closer is not necessarily better, and that some homeowners may actually see a loss in value to their property.

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A Appendix

A.1 Complete Estimation Results

Table A1: Full Results Table

Dependent Variable:	log(house price)		
	Baseline Results	Proximity Model	Green Party Votes
A. Housing characteristics			
Under construction	−0.0520*** (0.0050)	−0.0520*** (0.0050)	−0.0521*** (0.0050)
Age	−0.0062*** (0.0001)	−0.0062*** (0.0001)	−0.0062*** (0.0001)
Age ²	0.0000*** (0.0000)	0.0000*** (0.0000)	0.0000*** (0.0000)
Living space	0.0026*** (0.0000)	0.0026*** (0.0000)	0.0026*** (0.0000)
Plot area	0.0002*** (0.0000)	0.0002*** (0.0000)	0.0002*** (0.0000)
Number floors	−0.0028*** (0.0007)	−0.0028*** (0.0007)	−0.0028*** (0.0007)
Number bathrooms	0.0223*** (0.0008)	0.0223*** (0.0008)	0.0223*** (0.0008)
Number bathrooms (unknown)	0.0404*** (0.0015)	0.0404*** (0.0015)	0.0405*** (0.0015)
Heating: Electric heating	−0.1268*** (0.0085)	−0.1269*** (0.0085)	−0.1257*** (0.0085)
Heating: Self-contained central heating	−0.0601*** (0.0076)	−0.0601*** (0.0076)	−0.0591*** (0.0076)
Heating: District heating	0.0253*** (0.0088)	0.0252*** (0.0088)	0.0253*** (0.0088)
Heating: Floor heating	0.0832*** (0.0072)	0.0831*** (0.0072)	0.0840*** (0.0072)
Heating: Gas heating	−0.0120* (0.0072)	−0.0121* (0.0072)	−0.0112 (0.0072)
Heating: Wood pellet heating	0.0092 (0.0093)	0.0091 (0.0093)	0.0100 (0.0093)
Heating: Night storage heating	−0.1237*** (0.0085)	−0.1237*** (0.0085)	−0.1226*** (0.0085)
Heating: Heating by stove	−0.2542*** (0.0080)	−0.2543*** (0.0080)	−0.2531*** (0.0080)

Continued on next page

Table A1 – *Continued from previous page*

Dependent Variable:	log(house price)		
	Baseline Results	Proximity Model	Green Party Votes
Heating: Oil heating	−0.0031 (0.0073)	−0.0031 (0.0073)	−0.0023 (0.0073)
Heating: Solar heating	0.2562*** (0.0203)	0.2562*** (0.0203)	0.2576*** (0.0203)
Heating: Thermal heat pump	0.1034*** (0.0072)	0.1034*** (0.0072)	0.1043*** (0.0072)
Heating: Central heating	−0.0232*** (0.0069)	−0.0233*** (0.0069)	−0.0222*** (0.0069)
Heating (unknown)	0.0434*** (0.0013)	0.0434*** (0.0013)	0.0433*** (0.0013)
Endowment: Normal	0.1545*** (0.0025)	0.1545*** (0.0025)	0.1546*** (0.0025)
Endowment: Sophisticated	0.2651*** (0.0030)	0.2651*** (0.0030)	0.2653*** (0.0030)
Endowment: Deluxe	0.4106*** (0.0051)	0.4106*** (0.0051)	0.4107*** (0.0051)
Number rooms	−0.0042*** (0.0005)	−0.0042*** (0.0005)	−0.0042*** (0.0005)
Condition: First occupancy after reconstruction	0.1078*** (0.0086)	0.1078*** (0.0086)	0.1074*** (0.0086)
Condition: Like new	0.0728*** (0.0024)	0.0728*** (0.0024)	0.0726*** (0.0024)
Condition: Reconstructed	0.0941*** (0.0035)	0.0941*** (0.0035)	0.0939*** (0.0035)
Condition: Modernised	0.0196*** (0.0025)	0.0196*** (0.0025)	0.0194*** (0.0025)
Condition: Completely renovated	0.0505*** (0.0031)	0.0505*** (0.0031)	0.0503*** (0.0031)
Condition: Well kempt	0.0016 (0.0021)	0.0016 (0.0021)	0.0014 (0.0021)
Condition: Needs renovation	−0.2593*** (0.0030)	−0.2592*** (0.0030)	−0.2593*** (0.0030)
Condition: By arrangement	−0.1218*** (0.0074)	−0.1217*** (0.0074)	−0.1218*** (0.0074)
Condition: Dilapidated	−0.5555*** (0.0163)	−0.5555*** (0.0162)	−0.5557*** (0.0162)
Condition (unknown)	0.0593*** (0.0013)	0.0593*** (0.0013)	0.0593*** (0.0013)

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Table A1 – *Continued from previous page*

Dependent Variable:	log(house price)		
	Baseline Results	Proximity Model	Green Party Votes
Age (imputed by median)	0.1337*** (0.0020)	0.1338*** (0.0020)	0.1338*** (0.0020)
Purchasing power per capita	0.0000*** (0.0000)	0.0000*** (0.0000)	0.0000*** (0.0000)
B. Proximity Variables			
Dist. to garden	−0.0075*** (0.0008)	−0.0075*** (0.0008)	−0.0076*** (0.0008)
Dist. to lake	−0.0022*** (0.0007)	−0.0022*** (0.0007)	−0.0022*** (0.0007)
Dist. to river	−0.0039*** (0.0007)	−0.0039*** (0.0007)	−0.0039*** (0.0007)
Dist. to stream	−0.0004 (0.0006)	−0.0004 (0.0006)	−0.0003 (0.0006)
Dist. to canal	−0.0031*** (0.0006)	−0.0031*** (0.0006)	−0.0031*** (0.0006)
Dist. to city center	−0.0080*** (0.0009)	−0.0080*** (0.0009)	−0.0078*** (0.0009)
C. Effects of Interest			
Dist. to PA	−0.0049** (0.0022)		
Dist. to park	−0.0274*** (0.0016)	−0.0273*** (0.0016)	−0.0273*** (0.0016)
Dist. to PA ²	0.0003 (0.0005)		
Dist to park ²	0.0017*** (0.0003)	0.0017*** (0.0003)	0.0017*** (0.0003)
Within PA	0.0058 (0.0151)	0.0150 (0.0169)	0.0186 (0.0354)
Within 1km to PA		0.0090 (0.0077)	0.0221 (0.0201)
Post PA	0.0058* (0.0034)	0.0069 (0.0071)	−0.0686*** (0.0184)
Green party vote	0.0050*** (0.0005)	0.0050*** (0.0005)	−0.0036* (0.0019)
Within PA × Post PA	−0.0507*** (0.0155)	−0.0500*** (0.0172)	−0.0704* (0.0361)
Within 1km to PA × Post PA		0.0000 (0.0076)	−0.0143 (0.0200)

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Table A1 – *Continued from previous page*

Dependent Variable:	log(house price)		
	Baseline Results	Proximity Model	Green Party Votes
Green party vote \times Within PA			0.0013 (0.0038)
Green party vote \times Within 1km to PA			−0.0009 (0.0020)
Green party vote \times Post PA			0.0087*** (0.0018)
Green party vote \times Post PA \times Within PA			0.0007 (0.0038)
Green party vote \times Post PA \times Within 1km to PA			0.0010 (0.0020)
Fixed-effects			
Year-Month FE	✓	✓	✓
5km Grid FE	✓	✓	✓
Fit statistics			
Observations	8,314,932	8,314,932	8,314,932
R ²	0.72566	0.72567	0.72578
Within R ²	0.47099	0.47101	0.47121

Notes: The table presents the complete regression output of the baseline model, the proximity model, which emphasizes the within 1 km to PA dummy, and the Green Party vote model, which specifies interactions with the Green Party vote share. Clustered standard errors at zip-code level are in parentheses. ***, **, and * denote statistical significance at 1%, 5% and 10%.

Source: Authors' table.