

Wrede, Matthias

**Article — Published Version**

## Voting on urban land development

Journal of Regional Science

**Provided in Cooperation with:**

John Wiley & Sons

*Suggested Citation:* Wrede, Matthias (2021) : Voting on urban land development, Journal of Regional Science, ISSN 1467-9787, Wiley Periodicals, Inc., Hoboken, USA, Vol. 62, Iss. 2, pp. 335-359, <https://doi.org/10.1111/jors.12565>

This Version is available at:

<https://hdl.handle.net/10419/264579>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*



<http://creativecommons.org/licenses/by-nc-nd/4.0/>

# Voting on urban land development

Matthias Wrede<sup>1,2</sup> 

<sup>1</sup>School of Business, Economics and Society,  
Friedrich-Alexander University  
Erlangen-Nürnberg (FAU),  
Nürnberg, Germany

<sup>2</sup>CESifo Research Network Fellow, Munich,  
Germany

## Correspondence

Matthias Wrede, Friedrich-Alexander  
University Erlangen-Nürnberg (FAU), School  
of Business, Economics and Society,  
P.O. Box 3931, 90020 Nürnberg, Germany.  
Email: [matthias.wrede@fau.de](mailto:matthias.wrede@fau.de)

## Abstract

In this paper, we analyze several local referendums on land development and land-use regulation in the City of Erlangen (Germany) between 2011 and 2018. To identify the positive influence of the travel distance on approval for land development, we control for distance to the city center and density, employ a two-way fixed-effect model, and use spatial instruments. We also analyze the heterogeneity of city dwellers' preferences for the development of residential and commercial areas. In particular, we examine the differences between homeowners and tenants in this regard.

## KEYWORDS

business and residential land use, distance decay, homeownership, land development, referendum

## 1 | INTRODUCTION

To adapt to demographic and economic changes, cities need to change land uses and develop fallow land. In referendums and local elections, and by lobbying, citizens can express their views on such changes. As projects generate winners and losers, land development projects must be enforced in political processes by organized political majorities. Knowing the factors that generate approval or rejection of urban development projects is essential to the success of such projects. This paper aims to identify some of these drivers and to determine the direction and extent of the impact by analyzing referendums on urban development projects in the City of Erlangen (Germany). In particular, we study the effects of travel distance from home to the project area and homeownership, as well as the difference between commercial and residential development projects.

In developed countries, the population and economic activities in urban areas are growing rapidly. Positive agglomeration effects on labor and goods markets, in production, and in consumption attract firms and individuals

---

This is an open access article under the terms of the Creative Commons Attribution-NonCommercial-NoDerivs License, which permits use and distribution in any medium, provided the original work is properly cited, the use is non-commercial and no modifications or adaptations are made.

© 2021 The Authors. *Journal of Regional Science* published by Wiley Periodicals LLC.

to the urban areas (Combes & Gobillon, 2015, Chap. 5; Rosenthal & Strange, 2004) and raise the demand for housing and space. There are multiple approaches to providing space for production areas and roads and to accommodate additional populations. The density and height of the buildings can be increased, and open spaces in the cities can be converted into commercial and residential areas. However, since physical and economic limits are set for interior growth, cities must also grow outward.

The migration to cities increases the utility of the voluntary immigrants and increases the total value-added, but is also associated with congestion costs and loss of green space. As long as the positive effects of agglomeration outweigh the negative effects, the influx into the urban regions increases the aggregate welfare. However, not everyone participates equally in this welfare increase; there are winners and losers. In addition to the immigrants, the landowners and homeowners whose property gains value win.<sup>1</sup> However, higher competition on housing and labor markets is at the expense of tenants and employees; the inhabitants of the city lose recreational areas, and the urban climate can deteriorate. Residents of neighborhoods directly adjacent to development and densification areas are typically negatively affected. Although some of the negative effects can be offset by transfers to communities and individuals and the expansion of public infrastructure, it is impossible to fully compensate all losers.

Although the institutions of land-use regulation vary considerably between countries, land use is the subject of state and/or local regulation in all developed countries (OECD, 2017).<sup>2</sup> Legislative and executive branches of local government determine the conditions of land use and the implementation of the rules. The change of land uses usually requires a complex legislative and/or administrative process. In this process, the beneficiaries and victims of a change attempt to exert influence through various forms of lobbying. In many places, direct votes, especially at the local level, are also allowed on land development projects (Caves, 1990).

In this paper, we will examine referendums in the City of Erlangen (Germany) on the development of former agricultural land and the densification of residential areas in 2011, 2017, and 2018. In 2011, a commercial park in the southeast of the city was put to the vote. In 2017, the residents voted on the modernization and densification of a residential area directly south of the city center. The vote in 2018 was about preliminary investigations for a residential area in the west of the city. We investigate how the distance between the district and the project area affects the consent to the area development or densification. The distance largely determines the individual assessment of an urban development project, since the accessibility of green spaces, traffic jams on traffic routes, and concerns about parking spaces, traffic-related noise, and air pollution vary greatly with distance, while the visibility of buildings and shading effects play a role for neighborhoods directly adjacent to development areas. Our focus is on travel distance, but we also target locations next door.

We analyze votes separately, where we control for distance to the city center and density, and jointly with a two-way fixed-effect model. Including vote district fixed effects, we can control for unobservable heterogeneity that is invariant over the votes. On the other hand, this limits our analysis to decision-relevant parameters that vary over the votes. With referendum-fixed effects, we can control for the location and characteristics of the development project. The fixed-effects approach assumes that preferences are stable over time and votes. However, with a little more than 100,000 inhabitants (including approximately 30,000 students), Erlangen is characterized by a strong population turnover. From 2010 to 2016, an average of 9302 people moved into the city each year, 8182 people moved away, and 6615 people moved within the city (Stadt Erlangen - Statistik und Stadtforschung, 2016). As we conclude from aggregated data to individual assessments, we must assume that the relationships between distance and socio-demographic variables and preferences are stable, despite the changing composition of the population.

The main variable of interest in this study is the travel distance between the location of the project and the centroids of the voting district. The inclusion of vote district fixed effects provides an opportunity to identify the

<sup>1</sup>For the homevoter hypothesis and empirical evidence, see, for example, Brueckner and Lai (1996), Brunner and Sonstelie (2003), Fischel (2001), and Hilber and Mayer (2009).

<sup>2</sup>For causes and effects, see Glaeser and Ward (2009), Hilber and Robert-Nicoud (2013), and Gyourko and Molloy (2015, Chap. 19).

causal effect of distance on approval rates because the development projects are located at different geographical points. Distance varies over the votes (and for every project over the voting districts).

The two-way fixed-effects approach controls for variables that are either time-invariant or space-invariant but does not control for variables that change differently in the districts over time. In selecting the project locations, however, the traffic connections play a role, so that the endogeneity of the road network is a possible identification obstacle that can be addressed with an instrumental-variable strategy. Therefore, we also conduct an instrumental-variable regression with a non-Euclidian distance measure, namely, the taxicab distance, as a novel instrument. To our knowledge, this distance measure has not been used as an instrumental variable.

In addition to the travel distance, in this paper we examine the heterogeneity of the approval rates between commercial development projects and residential development projects, as well as the consent between homeowners and tenants. Since commercial projects increase the demand for labor and thus the demand for housing, while residential projects increase the supply of housing, we expect that homeowners will support residential projects less strongly than tenants compared with commercial projects. In addition, since traffic-related negative externalities through noise and air pollution are stronger in commercial projects than those in residential projects, we suspect that the decrease with distance is stronger for the former.

The main contribution of this paper to the literature is that a positive influence of the travel distance between the constituency and the project location on the consent to the area development can be identified. However, we do not find any significant additional effect of next-door locations. We provide evidence that the share of homeowners correlates more negatively with approval ratings of residential area projects than that with approval ratings of commercial area projects. Furthermore, we show that the importance of distance varies depending on the type of project. The travel distance has a stronger effect on the consent to a commercial area than that on the consent to some, but not all, residential development projects. Due to the small number of observations, however, we cannot examine in depth the complete interplay between the three determinants of the voting results—project type, homeownership, and distance; this is reserved for future research.

The paper is organized as follows. Section 2 provides a brief overview of the related empirical literature. Section 3 follows with a presentation of the theoretical background. Section 4 presents the data and institutional background. Then, Section 5 develops the empirical model, and Section 6 describes the results. Section 7 concludes these findings.

## 2 | RELATED EMPIRICAL LITERATURE

While the lack of information about actors, instruments, and finances usually makes it difficult for researchers to fully understand lobbying and assign lobbying activities to groups and individuals, democratic votes are well documented. In free elections by secret ballot, the individual voting behavior is unobservable but can be either queried in surveys before or after the election process or analyzed at the precinct level.

Both research strategies have advantages and disadvantages. Survey data are not subject to aggregation bias, but can directly consider individual characteristics and analyze individual assessments. On the other hand, for example, unobservable characteristics of participants, selection into the survey, selective social desirability, and consent tendencies might bias results. More generally, since it is difficult to implement realistic, incentive-compatible experiments in surveys, surveys tend to capture stated preferences rather than revealed preferences.

Uncovering the views or behaviors of individuals from aggregated data always carries the risk of ecological fallacy, which is, on the one hand, based on group formation itself and, on the other hand, on the different distributions of relevant individual characteristics (Gotway & Young, 2002). Moreover, identifying individual determination factors for the choice decision from voting results is made more difficult by measuring errors and unobserved variables. In many cases, for example, the sociodemographic data are not available for the electoral districts, but are available for areas of a different geographical format selected for statistical purposes (e.g., because

it is larger, smaller, or overlapping). Then, it is necessary to assign the data of the statistical areas to the voting districts by algorithms, which unavoidably results in measurement errors. More importantly, there are typically no data on some potentially decision-relevant parameters. Data on income, rent, household structure, and leisure activities, as examples, are often not available at a small scale or are imprecisely measured. Some parameters can be approximated; others are completely unobservable. If the unobservable variables are correlated with the explanatory variables of interest, the estimation results are biased.

Since neither research strategy is superior to the other, both strategies have been widely used in the literature on land development projects.

First, based on surveys, various studies have examined the individual attitudes toward land development projects. Examining data from a national survey in the UK, Coelho et al. (2017) concluded that owner-occupiers tend to express greater opposition to local house building. Hankinson (2018) conducted a factorial survey in the United States and a standard survey in San Francisco, where he found that homeowners are sensitive to housing's proximity, but renters are sensitive to housing's proximity only in the high-rent city San Francisco, which he interpreted as evidence for context sensitivity. The factorial survey identifies the causal effect of proximity on attitudes, but not the causal effect of respondents' characteristics.

Second, various studies examine the effects of homeownership and proximity on the approval rates in a local referendum on a single development project: Ahlfeldt and Maennig (2012) analyzed a 2001 referendum on a soccer stadium in Munich in Germany and found that most voters supported the sports arena, but voters in the proximity of the proposed site opposed the project. Coates and Wicker (2015) investigated the 2013 referendum on Winter Olympics in Munich 2022 and found a more positive attitude toward the Munich Olympic bid in potential host communities, but also found evidence that voters were concerned with the crowding-out of regular tourists. Considering referendums on professional sports facilities in two different states in the United States, Coates and Humphreys (2006) detected net benefits of proximity to stadiums. Analyzing the referendum on an airport project in the City of Berlin (Germany), Ahlfeldt and Maennig (2015) showed that homeowners support initiatives that positively affect the amenity value more strongly than tenants. Building on Dehring et al. (2008), Ahlfeldt and Maennig (2015) analyze the interaction effect of local price signals, triggered by previous announcements about the planning, and the homeownership rate on the voting results.<sup>3</sup> In their study on the negative effect of age on consent to a major railroad project in Germany, Ahlfeldt et al. (2020) also confirmed the negative relationship between proximity and consent, as well as between homeownership and consent.

Third, because most studies analyze only one referendum, unobservable area characteristics might uncontrollably affect the estimation results. For example, both homeownership and proximity might be related to the accessibility of open space and the local level of pollution, which most likely impact voting decisions. However, only a few studies consider several referendums at a time. Pleger (2017) analyzed the self-reported voting decisions in federal popular votes on 18 land-use measures in Switzerland between 1984 and 2008 and found that the main individual factors to explain democratic acceptance are party affiliations of voters and homeownership. Because Pleger's study is based on repeated cross-sectional analyses and not on a longitudinal study, the author could not control for the time-invariant unobservable characteristics of respondents. Due to the long period, changes in the underlying relationships may distort the results. Pleger's study is not concerned with voting at the local level. The lower expected impact on the outcome might produce different results than expected at the local level. Similar to our study, Gerber and Phillips (2003) also analyzed various polls in San Diego (California, USA), but they focus on the political process and, more importantly, do not include precinct fixed effects. These authors found that interest group endorsement significantly increases public support for new development and show that voters often support measures that allow new development at that time.

<sup>3</sup>Since we did not have access to house prices over the relevant period, we could not adopt this strategy here. Furthermore, the number of observations is insufficient to identify the interaction effects of distance and ownership rate.

### 3 | THEORETICAL BACKGROUND

In analyzing voting on the development of new residential and commercial areas, we assume informed voters who maximize individual utility through their voting decision. When irrational behavior occurs, it is not thought to be systematically linked to the model's explanatory variables. In the following, we assume that the (indirect) utility is determined not only by wealth, income, and prices of goods, especially real estate prices and rents but also by local public goods and bads. On the basis of this assumption, we will formulate conjectures about how different development projects affect different groups of voters and their voting decisions. In doing so, we consider institutions and market conditions in the City of Erlangen.

The land proposed for development is currently used for agriculture, but the cultivated landscape also benefits ordinary citizens and visitors.<sup>4</sup> The land has an existence utility for the inhabitants of the City of Erlangen, which is lost due to the development. Since the areas under consideration are surrounded or crossed by publicly accessible paths, the areas also have utility as recreational areas, which depend on accessibility. Therefore, the loss of utility will be weaker if the area in question is further from the voter's home.

The owners and users of agricultural land are most affected by a change in the permissible land use and, thus, the conversion of agricultural land into residential or commercial areas. The existing agricultural land is at least partially leased to farmers so that, in many cases, owners and users are not the same people. As the land value increases significantly with the change in the rights of use, landowners generally benefit from a use change. This might not apply if expropriations or "forced" sales occur during development, and the remaining farm size is no longer profitable. The leaseholders of agricultural land that is becoming building land are losers of land-use change and, therefore, in the political process, particularly committed opponents of such changes. In large areas, the survival of a farm, which leases a large part of the cultivated area, can be endangered in individual cases. Landowners and leaseholders in the project area represent only a small minority of the city's population, which cannot directly affect the outcome of a vote. Indirectly, however, who are badly affected financially will have a considerable influence on the voting results through lobbying activities.

New residential areas increase the number of users of the public infrastructure, especially roads. The associated costs of the settlement must primarily be borne by the residents of neighboring areas. Because of pollution and noise, commercial areas are likely to have even greater negative effects on neighbors.<sup>5</sup> In perfect housing markets, house prices and rents in affected areas will fall to offset the immediate negative effects on neighbors.<sup>6</sup> In perfect real estate markets, with perfect mobility, no spatial differences between identical individuals will persist in a spatial equilibrium.<sup>7</sup> The landowners must bear the cost of the negative externalities.<sup>8</sup> Immobility and fixed prices, however, result in an incidence that varies over space. If rents do not fall adequately to fully offset the negative externalities, not only landlords but also tenants in the vicinity of the project will suffer a loss of utility. In Germany, the regulation of existing rents has ensured that the level of existing rents is well below new contract rents. Existing rents are, therefore, largely downwardly rigid.

When the city opens up new residential areas, the demand for housing in the existing residential areas in the city area will initially fall. The value of land and housing will fall, and homeowners will suffer a loss of value. The position of the tenants, however, is strengthened; rent increases are harder to enforce. However, external influx diminishes these effects on the housing market. As the housing market in Erlangen was already very tight at the time of voting, and there was excess demand, immigration is expected to dampen, if not eliminate, land and rental price effects.

New business parks will create additional jobs that increase the demand for labor, thus reducing the risk of unemployment for the city's inhabitants and/or enabling wage increases. On the other hand, additional

<sup>4</sup>In one of the three projects studied, the area was already built, and the historic house stock that was to be demolished was considered by some citizens as a monument to the city's history.

<sup>5</sup>Positive externalities of housing projects are also possible. New attractive apartments may have a positive effect on the immediate vicinity and therefore have a spatially limited positive effect on real estate prices.

<sup>6</sup>For an early model on the effect of crowding externalities on the rent gradient, see, for example, Richardson (1977).

<sup>7</sup>For an overview of the standard urban economics model, see Fujita (1989).

<sup>8</sup>Koster and Rouwendal (2012) found that while mixed land use has a positive effect on house prices, manufacturing and wholesaling have not.

jobs due to induced immigration also increase demand in the local housing market and drive house prices and rents.

As additional residential areas increase housing supply and, thus, on average, lower property prices and rents, while additional commercial space increases the demand for housing and consequently increases property prices and rents, homeowners will rate residential development projects more negatively than tenants compared with business parks.

In summary, these theory-based considerations make it clear that the travel distance between the location of the project and the constituency and the ownership rate, and the nature of the project, impact the level of agreement in the constituency. We suspect that distance has a positive effect on the approval and applies even more to business parks than to residential projects (distance hypothesis). In addition, we expect the ownership rate to be more negative for the approval of housing projects than for the approval of business parks (homeownership hypothesis).

## 4 | INSTITUTIONS AND DATA

The City of Erlangen has about 110,000 inhabitants and is the eighth-largest city in Bavaria (Germany). It is located in northern Bavaria close to Nuremberg. Measured by gross domestic product per worker, Erlangen is the third most productive city in Bavaria after Ingolstadt and Munich.

Since 1995, there have been referendums in Bavaria as an element of direct democracy. A citizen request must be submitted to the municipality and contain a question that must be answered with "yes" or "no" and a justification. In the case of a referendum, the question is decided by the majority of valid votes cast. In municipalities with more than 100,000 inhabitants, this majority must be at least 10% of the eligible voters. Eventually, a referendum has the effect of a municipal council decision.

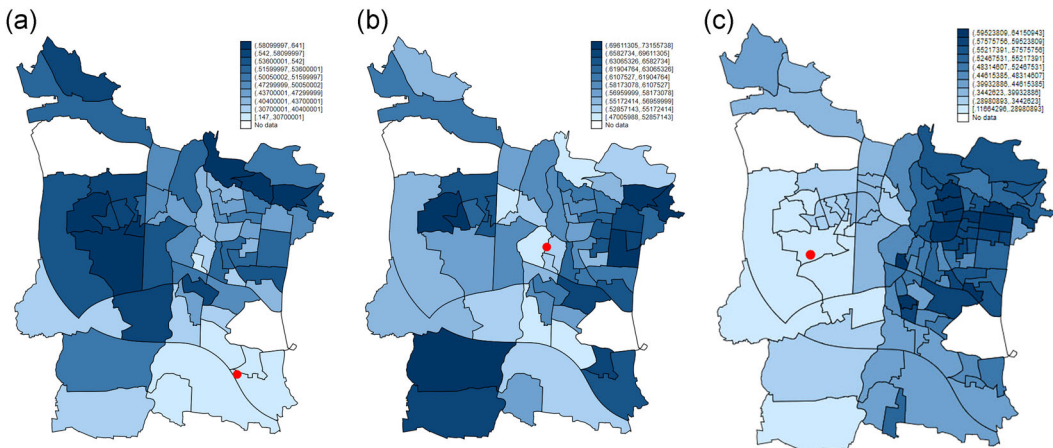
This study deals with three referendums. In 2011, a commercial park in the southeast of the city was put to the vote (R2011). In 2017, there was a vote on the densification and modernization of a residential area directly south of the city center (R2017). The vote in 2018 was about preliminary investigations for a residential area in the west of the city (R2018). The appendix shows the wording of these three referendums. Resistance to all three projects developed in citizen movements, mainly organized and supported by directly affected residents. In the 2011 and 2018 projects, which would have led to a reduction in arable land, the affected farmers and nature conservation groups played an important role in the citizens' initiatives. Although the opposition parties partially supported the protests, the conflict was not perceived as being partisan. The benefits for the development of the city were questioned in all projects. The opponents argued that the city administration's calculations of needs and costs were not credible, existing structures were destroyed and the selected locations were unsuitable for urban development without specific alternatives being mentioned. In the 2011 and 2018 projects, the critics complained about additional immigration and commuting. Environmental protection and the protection of historical buildings also played an important role in the public discussion. The city government emphasized the lack of commercial space or affordable housing in the city area. It attempted to address concerns about increasing traffic and stressed that the locations require comparatively little environmental and architectural intervention.

Data on voter turnout, election results, and on sociodemographic and geographic data of the sites subject to a referendum are provided by the Department of Statistics and City Research of the City of Erlangen. All sociodemographic data, taken from the respective Statistical Yearbook, refer to December 31 of the previous year.<sup>9</sup> The sociodemographic data are not available at the level of voting districts but only at the level of statistical districts, which are often larger, and in some cases, overlapping.<sup>10</sup> We assign the data of the statistical districts to the voting

<sup>9</sup>Because housing data for December 31, 2017 were not provided, we use housing data for December 31, 2018. Since the referendum in 2018 took place on October 14, 2018, the changes in the housing stock in 2018 after the referendum are likely to be minor.

<sup>10</sup>For December 31, 2018, the Department of Statistics and City Research provided some sociodemographic data at the level of local voting districts for the first time. We used this data to test the quality of the spatial matching process we use. The mean values given by the department of statistics for the proportions of foreigners and age groups are very similar to our calculated values. However, the standard deviation of the data we compute is less, since the number of statistical districts is considerably smaller than the number of constituencies for local elections. See Table A1 in the appendix.





**FIGURE 1** Shares of 'yes' votes of referendums R2011, R2017, and R2018. Note: Voting-district shares of the votes in favor of development in referendums R2011, R2017, and R2018; respective project location marked by red dot

districts in proportion to the built-up areas weighted by eligible voters per  $m^2$ .<sup>11</sup> The spatial delineation of electoral districts changes slightly over time and differs between the votes that are held separately and the votes that are held simultaneously with a state election. The R2011 and R2017 referendums were carried out separately, the R2018 referendum was done simultaneously with a state election. For R2011, we do have data for the 56 voting districts. Due to new developments in the eastern part of the City of Erlangen, one voting district was divided into two new districts; therefore, the number of voting districts of the R2017 referendum was 57. For the state election and the R2018 referendum, the city was divided into 97 voting districts. For the baseline analysis, all data will be converted into the constituencies at the 2011 vote. For the 2017 vote, the loss of information is marginal. For the 2018 vote, significantly more information is lost since the electoral districts are smaller in state elections than those in separate elections (demarcation is also used for European elections).

Area and population differ considerably between the individual electoral districts. In 2011, there were between 490 and 2032 eligible voters in the individual districts, an average of 1428.21. A few, more rural electoral districts, including agricultural areas and forest areas, are more than 30 times as large as the smallest urban electoral districts (see Figure 1); however, the population there is also concentrated in small areas. The distance, for example, between the 2011 project site and the centroid of the electoral district varies between 582.61 and 10623.99 m.

Our voting outcome of interest is the proportion of 'yes' votes among all valid votes, where yes stands for approval of the development project, but we also consider turnout. Due to the simultaneous state election, the turnout in 2018 was significantly higher than in 2011 and 2017. Table 1 shows voting outcomes ('yes' shares and turnout).

<sup>11</sup>We convert all ratios into countable data. Assuming uniformly distributed individuals, we convert data from the source regions (i.e., the statistical districts) into data for the target regions (i.e., voting districts) according to the following formula:

$$N_{T_j} = \sum_i \frac{\mu(T_j \cap S_i) V_{T_j}}{\sum_k \mu(T_k \cap S_i) V_{T_k}} N_{S_i},$$

where  $S_i$  indicates the source region  $i$ ,  $T_j$  the target region  $j$ ,  $\mu$  the built-up area size,  $V$  eligible voters per  $m^2$  built-up area,  $N$  the number of individuals under consideration (for spatial interpolation with various weighting matrices, see Amtz and Wilke (2007) and Goodchild and Lam (1980)). To avoid distortions due to large contiguous uninhabited areas, we link sociodemographic data based on built-up areas instead of the total areas of statistical districts and electoral districts. Furthermore, we have decided not to interpolate, as the features and age of the buildings and the composition of the population can vary greatly among streets.



**TABLE 1** Voting outcomes

Variable	Mean	Std. Dev.	Min.	Max.	N
R2011: yes	0.473	0.101	0.147	0.641	56
R2011: turnout	0.172	0.098	0.071	0.646	56
R2017: yes	0.604	0.062	0.47	0.732	57
R2017: turnout	0.333	0.074	0.207	0.488	57
R2018: yes	0.462	0.12	0.117	0.642	97
R2018: turnout	0.558	0.097	0.376	0.823	97

Figure 1 shows maps displaying the shares of 'yes' votes of referendums R2011, R2017, and R2018. The red dots indicate the location of the respective project sites (in the southeast, R2011; in the center, R2017; in the west, R2018). The figure shows that the proportions of 'yes' votes in the individual electoral districts vary greatly between votes. This indicates that the characteristics of the electoral districts or the respective residents alone do not determine the voting behavior. Above all, however, the figure shows that the distance of the project location from the electoral district is positively linked to the proportion of 'yes' votes.

Our preferred measure of distance is travel distance (in meters).<sup>12</sup> Alternatively, we could have measured distance as Euclidean distance between the centroids of the respective areas. Although both distance measures are strongly correlated, the impact of additional traffic, including traffic-related pollution, and demand for parking space as well as the lost recreational benefits will vary with travel distance, and not Euclidian distance. Different forms of localized pollution (visual, air, and noise pollution) only play a special role when the straight-line distance is very short. Therefore, we control separately for locations next door.

For 2011, the Federal Statistical Office of Germany provides data from the 2011 German Census on homeownership for 100×100 m grids ([www.zensus2011.de](http://www.zensus2011.de)), which we match with voting districts. This data has the advantage that it is available for small spatial units; however, small values are deliberately coarsened or not shown to ensure data protection. Because ownership and availability of green spaces are correlated with population density, we control for density (inhabitants per km<sup>2</sup>). To control for geographic location in the city, we use the Euclidean distance between the centroid of the electoral district and the city center.

To account for large shifts in the population composition, we also use some sociodemographic variables as controls. We consider age (the share of the elderly—65 years old and older), gender (the share of females), and nationality (the share of foreigners), and the composition of households (the share of singles and the share of single parents). Tables A2 and A3 in the appendix show summary statistics for density and the sociodemographic variables in 2011 and 2018. With one exception, the sociodemographic variables change only slightly. Due to the EU expansion in 2007 with delayed free movement of persons and the refugee immigration, the share of foreigners substantially increased after 2011. Therefore, we control for the share of foreigners in some regressions. Finally, to consider differences in political participation, we use voter turnout from past federal elections as a control variable.

<sup>12</sup>Using the Distance Matrix API, we obtain the travel distances between the project sites and the centroids of the voting districts from the Google Maps Platform retrieved on December 19, 2019 (Google, 2019). Because the travel time varies with the time of day, the day of the week, the month, the year, and various events, we decided to use travel distance rather than travel time. As means of transport, we chose bicycles, as cycling in Erlangen is very common, and the bike network is a good compromise between the complete network of roads and paths and the less extensive road network.

## 5 | EMPIRICAL MODEL

To examine the effects on the voting behavior of distance, homeownership, and project type, we carry out cross-sectional and panel analyses. As mentioned, our main voting outcome of interest is the proportion of 'yes' votes among all valid votes. We regress the voting outcome on the log of travel distance between the voting district and the project site, on homeownership and various other variables.

The estimation equation of the cross-sectional analysis for a referendum is

$$y_i = \alpha_0 + \alpha_1 d_i + \alpha_2 h_i + \alpha_3 c_i + \alpha_4 \mathbf{X}_i + \epsilon_i, \quad (1)$$

where  $i$  indicates the voting district,  $y_i$  the voting outcome in voting district  $i$ ,  $d_i$  the log of travel distance between the centroid of the voting district and the centroid of the site subject to a referendum,  $h_i$  the indicator of the homeowners' share in district  $i$ ,  $c_i$  the dummy variable 'next door' indicating Euclidian distances less than 1150 m,<sup>13</sup>  $\mathbf{X}_i$  the vector of sociodemographic controls in district  $i$ , and  $\epsilon_i$  the error term.

As discussed in Section 3, we hypothesize that travel distance has a positive effect on the approval rate ( $\alpha_1 > 0$ ).<sup>14</sup> Thus, locations next door should be negatively affected ( $\alpha_3 < 0$ ). From the homeownership hypothesis follows that in the vote on an additional residential area, homeownership should have a more pronounced negative or a less pronounced positive effect than that in the other votes ( $\alpha_2^{R2018} < \alpha_2^{R2011}$ ).<sup>15</sup> Our modeling selection strategy is 'from specific to general.' We begin with our main variables of interest and, then, add additional variables step-by-step, including sociodemographic controls. To take selective residence choices into account, we control for the log distance to the city center and density. To account for general differences in political participation, we use voter turnout from past federal elections as a control variable. Since we do not include voter participation in the referendum itself in the set of controls, the coefficients  $\alpha_1$  and  $\alpha_2$  also include the indirect effects of distance and homeownership on the proportion of 'yes' votes that result from a change in voter turnout. Finally, since the share of foreigners is rather volatile, we also control for nationality.

The two dimensions of the panel analysis are voting districts and referendums and the estimation equation is

$$y_{ij} = \beta_0 + \beta_1 d_{ij} + \beta_2 \gamma_j d_{ij} + \beta_3 h_{ij} + \beta_4 \gamma_j h_{ij} + \beta_5 c_{ij} + \beta_6 \mathbf{X}_{ij} + \delta_i + \gamma_j + \mu_{ij}, \quad (2)$$

where  $j$  indicates the referendum,  $\delta_i$  the voting-district-fixed effect,  $\gamma_j$  the referendum-fixed effect, and  $\mu_{ij}$  the error term.

In analogy to the cross-sections, we expect that the coefficient of travel distance,  $d_{ij}$ , is positive, and the coefficient of the dummy variable 'next door,'  $c_{ij}$ , is negative. Furthermore, both the coefficient of the interaction term of the referendum-fixed effect and distance,  $\gamma_j d_{ij}$ , and the coefficient of the interaction term of the referendum-fixed effect and homeownership,  $\gamma_j h_{ij}$ , should be negative when the reference category is the referendum on a commercial project.

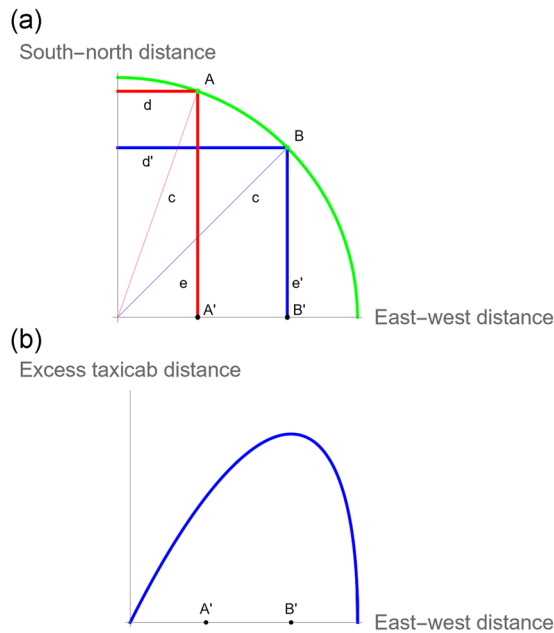
Our research design enables us to identify the effect of distance on the approval rate if the following assumptions hold:

- Opponents or proponents have not selected their residences so that they are systematically in lesser or greater distance from the development projects.
- The politicians have not selected the projects so that they are systematically in lesser or greater distance from the residences of opponents or proponents of such projects.

<sup>13</sup>We choose 1150 m to ensure that there are at least two voting districts in this range in every referendum.

<sup>14</sup>For the urban development project of 2018, a particularly steep distance gradient is also to be presumed because this project could lead to a so-called urban planning development measure, which might allow the authorities to expropriate. Local farmers would, therefore, be negatively affected not only as lessees but also as landowners.

<sup>15</sup>Since R2017 affects housing supply only marginally,  $\alpha_2^{R2017}$  and  $\alpha_2^{R2011}$  are probably not systematically different.



**FIGURE 2** Taxicab distance versus Euclidean distance (a,b). *Note:* (a) Euclidean distance  $c$ , taxicab distances  $d + e$  and  $d' + e'$ ; (b) difference between taxicab distance and a fixed level of Euclidean distance

- Regarding travel distances, the network of roads and paths must be stable, meaning that minimum travel distances between project locations and the centroids of voting districts do not change over time.
- There are no unobserved time-varying sociodemographics and area characteristics that substantially affect voting and are correlated with our variables of interest.

The first assumption is likely to hold since the development projects are spread over the city area. In addition, it is difficult for ordinary citizens to forecast the location and schedule of projects well in advance. The second assumption will probably also hold. Although citizens' preferences and satisfaction with the housing situation and life in Erlangen are regularly surveyed by the Department of Statistics and City Research of the City of Erlangen, and referendums on urban development projects have taken place in the past, detailed knowledge of politicians on the spatial distribution of consent to specific development projects is very unlikely. Given the limited space available for development projects in the City of Erlangen, the political flexibility in selecting locations is also very small (see Figure A1 in the appendix). The project site of R2018 was already proposed in a city development plan as early as 1978. A targeted choice of location based on the spatial distribution of consent and thus reverse causality, therefore, seems unlikely. The third assumption holds only approximately because smaller construction measures, which influence the optimal routing choice, are implemented every year. In particular, bikeways and one-way streets have been established for years. However, there is no evidence for a systematic link between the projects under study, which was at the planning stage at the time of the referendum, and the further development of the transport network. Of course, since we do not have access to income and education data, the fourth assumption might also be violated.

Due to the unpredictability and spatial distribution of the development project locations, it can largely be ruled out that citizens specifically chose to live near possible project locations. Nevertheless, selective residence choices can lead to endogeneity concerns. Furthermore, since accessibility is a major determinant of the project locations, endogeneity of the road network is also an issue. Because we cannot therefore

**TABLE 2** OLS/IV regressions (R2011, R2017, and R2018) (a)

	(1)	(2)	(3)	(4)	(5)	(6)
ln(travel distance)	0.165*** (0.0151)	0.0329*** (0.00955)	0.179*** (0.0210)	0.167*** (0.0154)	0.0423*** (0.0100)	0.210*** (0.0225)
Constant	-0.977*** (0.135)	0.340*** (0.0722)	-1.062*** (0.177)	-0.992*** (0.137)	0.265*** (0.0762)	-1.326*** (0.191)
N	56	56	56	56	56	56
F	118.5	11.89	72.67			
$\chi^2$				116.4	17.71	86.67
R <sup>2</sup>	0.622	0.104	0.502	0.622	0.0952	0.487
R <sub>a</sub> <sup>2</sup>	0.615	0.0869	0.493	0.615	0.0784	0.477
RMSE	0.0629	0.0586	0.0855	0.0618	0.0578	0.0852
First stage F(1, 54)				176.609	598.698	202.663

Note: (1) R2011 OLS, (2) R2017 OLS, (3) R2018 OLS, (4) R2011 IV, (5) R2017 IV, and (6) R2018 IV.

Heteroscedasticity robust standard errors in parentheses.

Abbreviations: IV, instrumental variable; OLS, ordinary least squares; RMSE, root-mean-square error.

\* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ .

completely rule out that travel distance is correlated with the error term, to identify the effect of travel distance, we apply three different strategies. First, to take into account preferences for access to the central business district and at the same time to the green belt, in the cross-sectional analyses, we control for distance to the city center and density. Second, in the panel analysis we control for vote district fixed effects. Third, to account for an endogenous road network, we also instrument for travel distance with the taxicab distance, which is the sum of the absolute values of the differences in longitude and latitude between the project site and the voting districts, for which we use degree as a unit (Krause, 1986).<sup>16</sup> The taxicab distance is imperfectly related to the Euclidian distance via the Pythagorean theorem and, thus, most likely a strong instrument. In Figure 2a, the Euclidian distance is the same for locations A and B, whereas the taxicab distance is larger for B than that for A. Figure 2b shows the relationship between the east–west distance and the difference between taxicab distance and Euclidian distance for a fixed level of Euclidian distance. Figure A2 in the appendix, showing logarithmic taxicab distance and fitted values versus logarithmic travel distance for the pooled referendums, demonstrates that logarithmic travel distance and logarithmic taxicab distance are highly but not perfectly correlated.<sup>17</sup> Since Erlangen is not a planned city in a checkerboard pattern, taxicab distance addresses the endogeneity of the road network.<sup>18</sup>

In addition to the percentage of ‘yes’ votes, voter turnout is also an important voting outcome, especially if there is a quorum. Therefore, we also carry out the estimates described for voter turnout as a left-hand-side variable. The closer the projects are, the more the direct effects of the projects can be perceived, so we expect distance to harm participation.

<sup>16</sup>Since the distances in our study area are so short, we ignore the curvature of the earth in our discussion.

<sup>17</sup>The figure also indicates that there is no systematic relationship between distance and residuals. In fact, linear regressions of the residuals against travel distance show that neither residuals nor absolute values of residuals are significantly related to distance. If referendums are analyzed separately, some referendums show a weakly negative relationship of residuals to travel distance, while others do not.

<sup>18</sup>We have not used straight-line distance as an instrument for travel distance as Heblich et al. (2020) did, since our definition of locations next door is based on Euclidian distance.

**TABLE 3** OLS/IV regressions (R2011, R2017, and R2018) (b)

	(1)	(2)	(3)	(4)	(5)	(6)
ln(travel distance)	0.172*** (0.0160)	0.0628*** (0.0150)	0.135 (0.0194)	0.170*** (0.0157)	0.0774*** (0.0168)	0.142*** (0.0159)
Homeownership rate	0.102* (0.0610)	0.0696 (0.0646)	-0.277*** (0.0477)	0.101* (0.0584)	0.0693 (0.0613)	-0.262*** (0.0464)
ln(distance city center)	0.00393 (0.00251)	0.00722*** (0.00175)	0.00129 (0.00308)	0.00384 (0.00242)	0.00688*** (0.00152)	0.00103 (0.00298)
Share foreigners	0.361 (0.240)	0.539* (0.174)	0.476*** (0.118)	0.354 (0.232)	0.613*** (0.159)	0.480*** (0.111)
Density	0.00000281 (0.00000421)	0.0000120*** (0.00000323)	0.00000719*** (0.00000233)	0.00000281 (0.00000395)	0.0000123*** (0.00000313)	0.00000742*** (0.00000213)
Turnout federal election	0.0643 (0.121)	0.266*** (0.0796)	0.444*** (0.130)	0.0634 (0.113)	0.250*** (0.0747)	0.412*** (0.120)
Constant	-1.203*** (0.206)	-0.287* (0.148)	-1.032*** (0.142)	-1.184*** (0.203)	-0.404** (0.160)	-1.080*** (0.116)
N	56	56	56	56	56	56
F	20.81	8.356	68.79			
$\chi^2$				126.1	49.05	553.7
R <sup>2</sup>	0.641	0.389	0.892	0.641	0.382	0.892
R <sub>a</sub> <sup>2</sup>	0.597	0.314	0.879	0.597	0.306	0.879
RMSE	0.0644	0.0508	0.0417	0.0602	0.0478	0.0391
First stage F(1, 49)				567.092	162.697	125.538

Abbreviations: IV, instrumental variable; OLS, ordinary least squares; RMSE, root-mean-square error.

Note: (1) R2011 OLS, (2) R2017 OLS, (3) R2018 OLS, (4) R2011 IV, (5) R2017 IV, and (6) R2018 IV.

Heteroscedasticity robust standard errors in parentheses.

\* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ .

## 6 | RESULTS

We consider the proportion of 'yes' votes among all valid votes as the main voting outcome. In our benchmark estimations, we exclude the dummy variable 'next door' from the analysis.

Tables 2 and 3 show the results of cross-sectional analyses (ordinary least squares [OLS] and instrumental variable [IV]) for the three referendums without and with covariates other than distance. Since we have little control in cross-sections over sociodemographic influences, an omitted-variable bias is likely and we trust more in our IV results. However, both OLS and IV regressions confirm the positive effect of distance on the approval rate.<sup>19</sup> Interestingly enough, for the densification project 2017, distance accounts for a much smaller share of the variance than for the other two projects, for which agricultural land is to be developed for commercial or residential use. Not only is the distance coefficient for all

<sup>19</sup>As expected, the instrument is strong: The  $F$  statistics of the first stage, listed in the table, is in any case above standard thresholds.

**TABLE 4** FE/IV-FE regressions (R2011, R2017, and R2018)

	(1)	(2)	(3)	(4)	(5)	(6)
ln(travel distance)	0.141*** (0.0123)	0.156*** (0.0174)	0.156*** (0.0158)	0.158*** (0.0146)	0.154*** (0.0183)	0.155*** (0.0157)
R2017	0.245*** (0.0124)	0.996*** (0.203)	0.952*** (0.195)	0.259*** (0.0144)	0.905*** (0.208)	0.887*** (0.197)
R2018	0.0255* (0.0128)	0.0540 (0.212)	-0.0190 (0.211)	0.0306** (0.0131)	-0.0775 (0.223)	-0.147 (0.221)
R2017 × ln(travel distance)		-0.0878*** (0.0251)	-0.0863*** (0.0241)		-0.0758*** (0.0255)	-0.0779*** (0.0241)
R2018 × ln(travel distance)		0.0127 (0.0241)	0.0161 (0.0230)		0.0278 (0.0254)	0.0305 (0.0241)
R2017 × homeownership rate		-0.109* (0.0606)	-0.0791 (0.0606)		-0.127** (0.0592)	-0.0924 (0.0588)
R2018 × homeownership rate		-0.369*** (0.0496)	-0.325*** (0.0491)		-0.362*** (0.0503)	-0.318*** (0.0506)
Share foreigners			0.216 (0.333)			0.254 (0.336)
Density			0.0000630** (0.0000310)			0.0000622** (0.0000307)
Turnout federal election			0.0399 (0.315)			0.0557 (0.318)
Constant	-0.765*** (0.104)	-0.902*** (0.153)	-1.169*** (0.290)	-0.915*** (0.125)	-0.880*** (0.162)	-1.169*** (0.293)
N	168	168	168	168	168	168
F	169.5	135.0	102.2			
$\chi^2$				563.5	1052.4	1168.2
$R_w^2$	0.740	0.862	0.871	0.735	0.861	0.870
$R_b^2$	0.0611	0.411	0.228	0.0611	0.396	0.235
$R_o^2$	0.550	0.761	0.343	0.541	0.755	0.353
AR $\chi^2(3)$				68.35	68.21	68.06

Note: (1) FE, (2) FE, (3) FE, (4) IV-FE, (5) IV-FE, and (6) IV-FE.

Heteroscedasticity robust standard errors in parentheses.

Abbreviations: AR, Anderson–Rubin; FE, fixed effect; IV-FE, instrumental variable fixed effect.

\* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ .

projects positive, but it is also significantly larger for the business park project R2011 than for the densification project R2017 (for OLS,  $\chi^2 = 27.86$ ), but not significantly different from the residential area project R2018. Hence, the second part of the distance hypothesis is only partially confirmed. Furthermore, the coefficient of the homeownership rate is negative for the residential project in 2018, but positive for the commercial project; the differences between the

**TABLE 5** OLS regressions controlling for locations next door (R2011, R2017, and R2018)

	(1)	(2)	(3)	(4)	(5)	(6)
ln(travel distance)	0.165*** (0.0151)	0.0329*** (0.00955)	0.179*** (0.0210)	0.162*** (0.0267)	0.0300** (0.0142)	0.182*** (0.0273)
Next door				-0.0101 (0.0554)	-0.00699 (0.0187)	0.0186 (0.0408)
Constant	-0.977*** (0.135)	0.340*** (0.0722)	-1.062*** (0.177)	-0.954*** (0.240)	0.364*** (0.113)	-1.093*** (0.233)
N	56	56	56	56	56	56
F	118.5	11.89	72.67	96.60	7.159	64.06
R <sup>2</sup>	0.622	0.104	0.502	0.622	0.104	0.503
R <sub>a</sub> <sup>2</sup>	0.615	0.0869	0.493	0.608	0.0705	0.484
RMSE	0.0629	0.0586	0.0855	0.0635	0.0591	0.0862

Note: (1) R2011 OLS, (2) R2017 OLS, (3) R2018 OLS, (4) R2011 OLS, (5) R2017 OLS, and (6) R2018 OLS.

Heteroscedasticity robust standard errors in parentheses.

Abbreviations: OLS, ordinary least squares; RMSE, root-mean-square error.

\* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ .

coefficients are statistically significant (for OLS,  $\chi^2 = 27.18$ ). These differences indicate that the homeownership hypothesis holds. The general political participation, measured in terms of voter turnout in federal elections, positively affects the approval rates of the residential projects but not the approval rates of the commercial project.

Table 4 shows the two-way fixed-effect regressions without and with instrumenting for travel distance. Instrumenting has no major impact on the crucial coefficients and their statistical significance.<sup>20</sup> Fixed-effects and instrumental-variable-fixed-effect regressions are quite similar. Both types of fixed-effect regressions strongly confirm the main distance hypothesis. The coefficient of distance,  $d_i$ , is positive at the 1% level. Regarding the second part of the distance hypothesis, the evidence is mixed. We had suspected that distance has a stronger positive effect on the approval of business parks than of residential projects, but the distance effect for the commercial area is only stronger than for densification of residential buildings (R2017) (i.e., the coefficient of the interaction term of the referendum-fixed effect and distance,  $\gamma_j d_{ij}$ , is negative for R2017). For R2018, this result does not hold; the interaction term coefficient is not statistically significant. The data support the homeownership hypothesis. The coefficient of the interaction term of the referendum-fixed effect and homeownership,  $\gamma_j d_{ij}$ , is statistically significantly negative for the land development project R2018, which would substantially increase the housing supply, but less significant for the densification project R2017, which would only marginally change housing supply.

*Locations next door:* Next, we include the dummy variable 'next door' in our analysis. Table 5 shows the results of cross-sectional analyses for the three referendums without any covariates other than travel distance and 'next door.' Two results are obvious: on the one hand, adding the dummy variable 'next door' does not change the coefficient of the travel distance or its significance. On the other hand, the variable 'next door' is not statistically significant and not consistently negative. The expected effect of locations next door does not materialize. Comparable results are obtained if the other estimates are expanded to include this variable. Table A4 in the appendix shows this as an example for the fixed-effect estimates. The proximity dummy 'next door' is not significant when

<sup>20</sup>According to the Anderson-Rubin (AR) test statistic, the instruments are strong. The Stata module *weakiv* by Finlay et al. (2013) provides the AR test statistic.



**TABLE 6** Voter turnout: FE/IV-FE regressions (R2011, R2017, and R2018)

	(1)	(2)	(3)	(4)	(5)	(6)
ln(travel distance)	-0.0604*** (0.0182)	-0.156*** (0.0230)	-0.152*** (0.0156)	-0.0635*** (0.0172)	-0.149*** (0.0242)	-0.151*** (0.0156)
R2017	0.111*** (0.0209)	-0.909*** (0.200)	-0.817*** (0.148)	0.108*** (0.0195)	-0.762*** (0.196)	-0.753*** (0.145)
R2018	0.369*** (0.0122)	-1.053*** (0.219)	-0.848*** (0.167)	0.368*** (0.0115)	-0.897*** (0.225)	-0.778*** (0.179)
R2017 × ln(travel distance)		0.112*** (0.0231)	0.106*** (0.0177)		0.0937*** (0.0226)	0.0980*** (0.0174)
R2018 × ln(travel distance)		0.159*** (0.0254)	0.143*** (0.0192)		0.142*** (0.0260)	0.135*** (0.0204)
R2017 × homeownership rate		0.128*** (0.0308)	0.123*** (0.0267)		0.151*** (0.0333)	0.137*** (0.0284)
R2018 × homeownership rate		0.111** (0.0423)	0.0837** (0.0413)		0.105** (0.0421)	0.0794* (0.0405)
Share foreigners			-1.181*** (0.184)			-1.202*** (0.185)
Density			0.0000451*** (0.0000163)			0.0000453*** (0.0000162)
Turnout federal election			-0.0788 (0.165)			-0.0783 (0.172)
Constant	0.703*** (0.163)	1.541*** (0.204)	1.562*** (0.169)	0.730*** (0.153)	1.480*** (0.215)	1.557*** (0.167)
N	168	168	168	168	168	168
F	712.5	966.3	1115.6			
$\chi^2$				2092.4	5954.4	8951.9
$R^2_w$	0.949	0.975	0.983	0.949	0.975	0.982
$R^2_b$	0.148	0.213	0.00160	0.148	0.186	0.00159
$R^2_o$	0.752	0.847	0.585	0.750	0.843	0.582
AR $\chi^2(3)$				34.61	60.67	69.27

Note: (1) FE, (2) FE, (3) FE, (4) IV-FE, (5) IV-FE, and (6) IV-FE.

Heteroscedasticity robust standard errors in parentheses.

Abbreviations: AR, Anderson–Rubin; FE, fixed effect; IV-FE, instrumental variable fixed effect.

\* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ .

sociodemographic controls are taken into account and the travel distance coefficient is almost unaffected. Moreover, instrumental-variable estimates are similarly affected (not shown). Hence, we conclude that travel distance more generally, rather than being located next door, is the crucial determinant of voting behavior and does not consider the variable ‘next door’ in the remaining estimations.

*Voter turnout:* We also examined voter turnout data, where we find on average a small negative effect of distance on voter turnout (see Table 6). As expected, the distance did not play a major role for votes that take place simultaneously as other votes, that is, for R2017 and R2018. With an average distance from the project location, the turnout for the residential projects is somewhat greater than the turnout for the business park. The closer the voting district is to the respective project location, the smaller the difference is. The respective interaction effects show that the additional housing provision has a positive effect on the influence of homeownership. On the one hand, this result is in line with the homeownership hypothesis; on the other hand, it can also be explained by the mobilization through other votes taking place at the same time in 2017 and 2018. Since foreigners with European Union citizenship are eligible to vote in local referendums, but probably less involved in local disputes, the share of foreigners has a strong negative effect on turnout.

*Robustness:* To get an idea of how strongly the conversion of the data into the constituency structure of 2011 influences the proportion of 'yes' votes, we estimate the OLS model for the referendum R2018 also for the original 97 electoral districts and compare the two cross-sections (see Table A5 in the appendix). The overall explanatory power of the model does not increase, and the coefficient of travel distance does not change by much. Hence, the distance hypothesis is again confirmed. More generally, results are quite similar for the variables of interest. We interpret the similarity of the results as an indication that the problem of ecological fallacy is relatively minor.

In 2017 there was also a referendum on the 'State Garden Show' (RGS2017), which would have led to the dismantling of parking sites in the city center. Because this project predominantly harms shoppers from suburban areas, it has a very different spatial distribution of effects and is, therefore, not included in the main analysis. However, we also conduct fixed-effect and instrumental-variable-fixed-effect regressions, including the RGS2017 referendum. Wording, descriptive statistics (Table A6), shares of 'yes' votes (Figure A3), and regression results (Table A7) are shown in the appendix. These fixed-effect and instrumental-variable-fixed-effect regressions confirm our previous results. The coefficient of distance is positive. The data only partially support the homeownership hypothesis. Interestingly, if we include interactions and controls, distance harms approval rates for the garden show. This result probably reflects that the residents of the outskirts districts fear losing parking opportunities in the city center during shopping or leisure activities in the evening or weekend through the State Garden Show. Because R2017 and RGS2017 take place on the same day, the negative effect of distance for the garden show can be seen even more directly by a fixed-effect regression for these two referendums, where fixed-effects control for all place- and time-specific unobservables (see Table A8 in the appendix for fixed-effect and instrumental-variable-fixed-effect regressions).

## 7 | CONCLUSION

In this paper, we analyzed several local referendums on land development in the City of Erlangen (Germany) in 2011, 2017, and 2018. Employing a two-way fixed-effect model, we demonstrate the positive influence of the distance on the approval of land development, which is particularly strong for business parks (distance hypothesis). Because being located next door has no noticeable consistent additional influence, we conclude that accessibility and traffic-related effects are decisive for referendums on development projects and less so the change in the view and additional noise directly on site. Furthermore, we show that, in comparison to the development of commercial areas, homeowners are more against the development of a new residential area than tenants (homeownership hypothesis). We introduced a new spatial instrument for travel distance and confirmed our results with an instrumental-variable estimation. Finally, we show that distance has a sizeable effect on voter turnout only when the vote is held separately.

## ACKNOWLEDGMENTS

This paper was presented at the 2019 European Meeting of the Urban Economics Association in Amsterdam, at the 2019 CESifo Workshop on Political Economy in Dresden, at the 2020 meeting of the European Regional Science

Association, and at the 2020 meeting of the German Economic Association. The comments of an anonymous referee of this journal and of the participants, and, in particular, of Martin Guenther, Andreas Mense, and Pilar Sorribas-Navarro are greatly appreciated.

## ORCID

Matthias Wrede  <https://orcid.org/0000-0001-8376-517X>

## REFERENCES

- Ahlfeldt, G., & Maennig, W. (2012). Voting on a NIMBY facility: Proximity cost of an "iconic" stadium. *Urban Affairs Review*, 48(2), 205–237.
- Ahlfeldt, G., & Maennig, W. (2015). Homevoters vs. leasevoters: A spatial analysis of airport effects. *Journal of Urban Economics*, 87, 85–99.
- Ahlfeldt, G., Maennig, W., & Steenbeck, M. (2020). Direct democracy and intergenerational conflicts in ageing societies. *Journal of Regional Science*, 60(1), 129–155.
- Arntz, M., & Wilke, R. A. (2007). An application of cartographic area interpolation to German administrative data. *Advances in Statistical Analysis*, 91(2), 159–180.
- Brueckner, J. K., & Lai, F.-C. (1996). Urban growth controls with resident landowners. *Regional Science and Urban Economics*, 26(2), 125–143.
- Brunner, E., & Sonstelie, J. (2003). Homeowners, property values, and the political economy of the school voucher. *Journal of Urban Economics*, 54(2), 239–257.
- Caves, R. W. (1990). Determining land use policy via the ballot box: The growth initiative blitz in California. *Land Use Policy*, 7(1), 70–79.
- Coates, D., & Humphreys, B. R. (2006). Proximity benefits and voting on stadium and arena subsidies. *Journal of Urban Economics*, 59(2), 285–299.
- Coates, D., & Wicker, P. (2015). Why were voters against the 2022 Munich Winter Olympics in a referendum? *International Journal of Sport Finance*, 10(3), 267–283.
- Coelho, M., Dellepiane-Avellaneda, S., & Ratnoo, V. (2017). The political economy of housing in England. *New Political Economy*, 22(1), 31–60.
- Combes, P.-P., & Gobillon, L. (2015). The empirics of agglomeration economies. In G. Duranton, J. V. Henderson, & W. C. Strange (Eds.), *Handbook of Regional and Urban Economics* (Vol. 5B, pp. 247–348). Elsevier B.V.
- Dehring, C. A., Depken, C. A., & Ward, M. R. (2008). A direct test of the homevoter hypothesis. *Journal of Urban Economics*, 64(1), 155–170.
- Finlay, K., Magnusson, L., & Schaffer, M. E. (2013). *Weakiv: Stata module to perform weak-instrument-robust tests and confidence intervals for instrumental-variable (iv) estimation of linear, probit and tobit models* (Technical Report). Statistical Software Components S457684, Boston College Department of Economics.
- Fischel, W. (2001). *The homevoter hypothesis*. Harvard University Press.
- Fujita, M. (1989). *Urban economic theory*. Cambridge University Press.
- Gerber, E. R., & Phillips, J. H. (2003). Development ballot measures, interest group endorsements, and the political geography of growth preferences. *American Journal of Political Science*, 47(4), 625–639.
- Glaeser, E., & Ward, B. (2009). The causes and consequences of land use regulation: Evidence from Greater Boston. *Journal of Urban Economics*, 65(3), 265–278.
- Goodchild, M. F., & Lam, N. S. (1980). Areal interpolation: A variant of the traditional spatial problem. *Geo-Processing*, 1, 297–312.
- Google. (2019). *Distance Matrix API*. <https://maps.google.com/maps/API/distancematrix>
- Gotway, C. A., & Young, L. J. (2002). Combining incompatible spatial data. *Journal of the American Statistical Association*, 97(458), 632–648.
- Gyourko, J., & Molloy, R. (2015). Regulation and housing supply. In G. Duranton, J. V. Henderson, & W. C. Strange (Eds.), *Handbook of Regional and Urban Economics* (Vol. 5B, pp. 1290–1337). Elsevier B.V.
- Hankinson, M. (2018). When do renters behave like homeowners? High rent, price anxiety, and NIMBYism. *American Political Science Review*, 112(3), 473–493.
- Heblisch, S., Redding, S. J., & Sturm, D. M. (2020). The making of the modern metropolis: Evidence from London. *Quarterly Journal of Economics*, 135(4), 2059–2133.
- Hilber, C. A. L., & Robert-Nicoud, F. (2013). On the origins of land use regulations: Theory and evidence from US metro areas. *Journal of Urban Economics*, 75, 29–43.
- Hilber, C. A. L., & Mayer, C. J. (2009). Why do households without children support local public schools? *Journal of Urban Economics*, 65(1), 74–90.

- Koster, H. R., & Rouwendal, J. (2012). The impact of mixed land use on residential land use. *Journal of Regional Science*, 52(5), 733–761.
- Krause, E. F. (1986). *Taxicab geometry: An adventure in non-Euclidean geometry*. Dover Publications.
- OECD. (2017). *Land-use planning systems in the OECD: Country fact sheets*. OECD Publishing.
- Pleger, L. E. (2017). Voters' acceptance of land use policy measures: A two-level analysis. *Land Use Policy*, 63, 501–513.
- Richardson, H. W. (1977). On the possibility of positive rent gradients. *Journal of Urban Economics*, 4(1), 60–68.
- Rosenthal, S., & Strange, W. (2004). Evidence on the nature and sources of agglomeration economies. In J. Henderson, & J. Thisse (Eds.), *Handbook of Regional and Urban Economics* (Vol. 4, pp. 2713–2739). Elsevier.
- Stadt Erlangen - Statistik und Stadtforschung. (2016). *Kleinräumige Bevölkerungsprognose*. Statistik aktuell 3/2016.

**How to cite this article:** Wrede, M. (2022). Voting on urban land development. *Journal of Regional Science*, 62, 335–359. <https://doi.org/10.1111/jors.12565>

## APPENDIX A

### A.1. The wording of the referendums

#### A.1.1. Referendum “Commercial area G6 Tennenlohe” on October 23, 2011 (R2011)

Are you in favor of the City of Erlangen continuing the urban development project and the land-use planning procedures initiated with the aim of realizing a new commercial park (G6) in Tennenlohe?

#### A.1.2. Referendum “ERBA settlement” on May 7, 2017 (R2017)

Are you in favor of the City of Erlangen using all legally permissible means to pursue a reversal of GEWOBAU's decision to demolish the historic buildings at Äußere Brucker Straße 82, 84, 86/88, Mainstraße 1, and Johann-Jürgen-Straße 1-7, with the goal of sustainable refurbishment and permanent preservation as social housing complexes with their associated gardens?

**TABLE A1** Real versus simulated values of voting-district sociodemographic variables 12/31/2018

Variable	Mean	Std. Dev.	Min.	Max.
Share foreigners	18.499	8.557	5.100	43.4
Generated share foreigners	18.733	7.302	5.514	40.993
Share age group 6 and younger	5.593	1.772	2.8	13.8
Generated share age group 6 and younger	5.539	1.153	1.894	8.048
Share age group 6–18	9.950	4.085	3.6	29.9
Generated share age group 6–18	9.863	3.026	3.615	16.884
Share age group 18–30	19.834	9.023	4.2	46.1
Generated share age group 18–30	20.026	8.032	11.593	43.386
Share age group 30–45	20.671	4.129	10.7	31.7
Generated share age group 30–45	20.685	2.813	9.455	25.971
Share age group 45–65	25.528	5.614	11.7	45
Generated share age group 45–65	25.517	4.739	10.152	37.344
Share age group 65 and older	18.44	7.684	3.1	47.8
Generated share age group 65 and older	18.37	6.96	6.781	51.23

For consistency, we recode the votes of the referendum R2017, that is, we recode the votes as if the wording were are you not in favor of the City of Erlangen using all legally permissible means to pursue a reversal of GEWOBAU's decision to demolish the historic buildings at Äußere Brucker Straße 82, 84, 86/88, Mainstraße 1, and Johann-Jürgen-Straße 1-7, with the goal of sustainable refurbishment and permanent preservation as social housing complexes with their associated gardens?

#### A.1.3. Referendum "Erlangen West III" on October 14, 2018 (R2018)

Are you in favor of continuing the preparatory investigation for a new district in the city west between Büchenbach and Steudach (Erlangen West III)?

#### A.2. Data quality

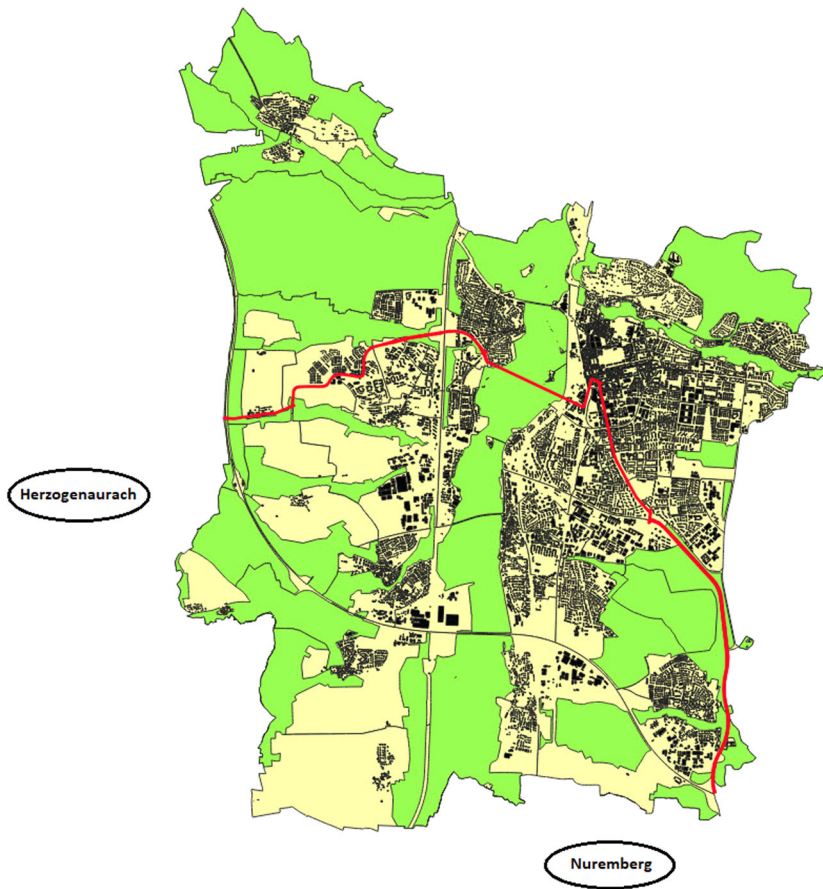
See Table A1.

**TABLE A2** Summary statistics for the 56 voting districts in 2011

Variable	Mean	Std. Dev.	Min.	Max.
Homeownership rate	0.357	0.196	0.022	0.848
Share 1-/2-dwelling buildings	0.677	0.209	0.188	0.948
Share social transfer recipients	0.061	0.053	0.003	0.188
Share age group 18–30	0.188	0.074	0.107	0.404
Share age group 30–65	0.468	0.043	0.243	0.547
Share age group ≥65	0.189	0.077	0.05	0.506
Share females	0.51	0.024	0.474	0.659
Share singles	0.23	0.085	0.109	0.432
Share single parents	0.019	0.007	0.006	0.032
Share foreigners	0.129	0.062	0.031	0.285
Density	3348.347	2532.188	150.039	9731.639

**TABLE A3** Summary statistics for the 56 voting districts in 2018

Variable	Mean	Std. Dev.	Min.	Max.
Share 1-/2-dwelling buildings	0.675	0.211	0.167	0.944
Share social transfer recipients	0.061	0.049	0.012	0.184
Share age group 18–30	0.201	0.081	0.112	0.439
Share age group 30–65	0.457	0.044	0.247	0.546
Share age group ≥65	0.189	0.071	0.064	0.463
Share females	0.502	0.02	0.466	0.604
Share singles	0.241	0.075	0.097	0.431
Share single parents	0.017	0.006	0.004	0.028
Share foreigners	0.18	0.073	0.065	0.398
Density	3600.178	2702.815	164.623	10190.541



**FIGURE A1** Land use in Erlangen. *Note:* The potentially available areas are shown light (yellow), the protected areas (protected areas, nature reserves) darker (green), and the buildings black. The red line indicates a projected light rail line

### A.3. Sociodemographic variables 2011 and 2018

See Table A2 and A3.

### A.4. Areas available for land development

Figure A1 shows that larger contiguous areas currently predominantly used for agriculture and available for urban development projects are found only in the west, southwest, and southeast. In addition, Figure A1 shows a projected light rail line connecting Erlangen, including the city center, with Nuremberg (the largest city in the region) and Herzogenaurach (headquarter of a DAX corporation). Due to the possible routing areas adjacent to the City of Erlangen and the travel times, there is little room for maneuvering on the Erlangen urban area. Since a good connection to this light rail and the city center for all development projects seems necessary, the area in the city's southwest is currently beyond consideration for a development project. Thus, for larger development projects, only the areas where the development projects of 2011 and 2018 are located remain. Moreover, the area of the development project of 2018 was already included in an urban development plan of 1978. Due to temporarily available conversion areas in the city's east, these plans were initially postponed. After these areas in the city's east were developed, the old plan was taken up again.

### A.5. Taxicab distance

See Figure A2.

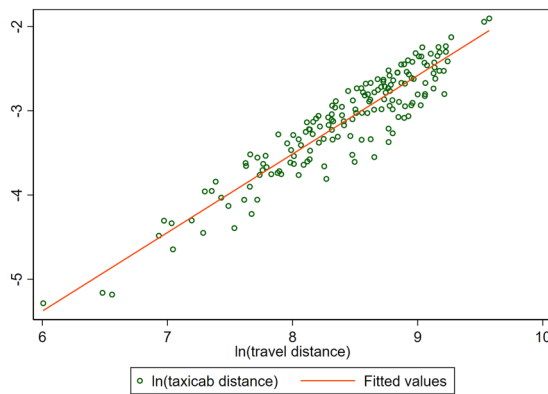
# A.6. Further regressions

See Tables A4 and A5.

# A.7. Referendum 'State Garden Show' (Landesgartenschau) on May 7, 2017 (RGS2017)

*The wording:* Are you in favor of stopping the planned State Garden Show in Erlangen?

For consistency, we also recode the votes of the referendum RGS2017 as if the wording were "Are you in favor of not stopping the planned State Garden Show in Erlangen?" (Tables A6, A7, and A8, and Figure A3).



**FIGURE A2** Taxicab distance versus travel distance. *Note:* The figure depicts  $\ln(\text{taxicab distance})$  and fitted values versus  $\ln(\text{travel distance})$  for the pooled referendums R2011, R2017, and R2018

**TABLE A4** FE regressions controlling for locations next door (R2011, R2017, and R2018)

	(1)	(2)	(3)	(4)	(5)	(6)
$\ln(\text{travel distance})$	0.141*** (0.0123)	0.156*** (0.0174)	0.156*** (0.0158)	0.164*** (0.0127)	0.154*** (0.0179)	0.156*** (0.0174)
R2017	0.245*** (0.0124)	0.996*** (0.203)	0.952*** (0.195)	0.257*** (0.0132)	1.018*** (0.202)	0.961*** (0.192)
R2018	0.0255* (0.0128)	0.0540 (0.212)	-0.0190 (0.211)	0.0324** (0.0131)	0.0587 (0.206)	-0.0158 (0.206)
$\text{R2017} \times \ln(\text{travel distance})$		-0.0878*** (0.0251)	-0.0863*** (0.0241)		-0.0906*** (0.0250)	-0.0874*** (0.0236)
$\text{R2018} \times \ln(\text{travel distance})$		0.0127 (0.0241)	0.0161 (0.0230)		0.0122 (0.0234)	0.0158 (0.0225)
$\text{R2017} \times \text{homeownership rate}$		-0.109* (0.0606)	-0.0791 (0.0606)		-0.109* (0.0604)	-0.0793 (0.0607)
$\text{R2018} \times \text{homeownership rate}$		-0.369*** (0.0496)	-0.325*** (0.0491)		-0.372*** (0.0498)	-0.327*** (0.0499)

(Continues)





TABLE A4 (Continued)

	(1)	(2)	(3)	(4)	(5)	(6)
Share foreigners			0.216 (0.333)			0.209 (0.343)
Density			0.0000630** (0.0000310)			0.0000631** (0.0000311)
Turnout federal election			0.0399 (0.315)			0.0386 (0.315)
Next door				0.0710** (0.0297)	-0.00924 (0.0177)	-0.00341 (0.0204)
Constant	-0.765*** (0.104)	-0.902*** (0.153)	-1.169*** (0.290)	-0.971*** (0.110)	-0.884*** (0.158)	-1.161*** (0.293)
N	168	168	168	168	168	168
F	169.5	135.0	102.2	127.0	121.2	92.85
$R_w^2$	0.740	0.862	0.871	0.752	0.862	0.871
$R_b^2$	0.0611	0.411	0.228	0.0620	0.414	0.228
$R_o^2$	0.550	0.761	0.343	0.555	0.762	0.343

Note: (1) FE, (2) FE, (3) FE, (4) FE, (5) FE, and (6) FE.

Heteroscedasticity robust standard errors in parentheses.

Abbreviation: FE, fixed effect.

\* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ .

TABLE A5 OLS regressions for R2018 (56 vs. 97 districts)

	56 Districts	97 Districts
ln(travel distance)	0.135*** (0.0194)	0.145*** (0.0143)
Homeownership rate	-0.277*** (0.0477)	-0.264*** (0.0374)
ln(distance city center)	0.00129 (0.00308)	-0.00148 (0.00446)
Share foreigners	0.476*** (0.118)	0.360*** (0.0933)
Density	0.00000719*** (0.00000233)	0.00000775*** (0.00000197)
Turnout federal election	0.444*** (0.130)	0.360*** (0.0776)

**TABLE A5** (Continued)

	56 Districts	97 Districts
Constant	-1.032*** (0.142)	-1.022*** (0.126)
<i>N</i>	56	97
<i>F</i>	68.79	104.8
<i>R</i> <sup>2</sup>	0.892	0.850
<i>R</i> <sub>a</sub> <sup>2</sup>	0.879	0.840
RMSE	0.0417	0.0478

Note: Heteroscedasticity robust standard errors in parentheses.

Abbreviations: OLS, ordinary least squares; RMSE, root-mean-square error.

\**p* < 0.1; \*\**p* < 0.05; \*\*\**p* < 0.01.

**TABLE A6** Summary statistics for referendum RGS2017

Variable	Mean	Std. Dev.	Min.	Max.	<i>N</i>
Yes	0.313	0.072	0.179	0.492	57
Turnout	0.334	0.074	0.207	0.491	57

**TABLE A7** FE/IV-FE regressions (R2011, R2017, RGS2017, and R2018)

	(1)	(2)	(3)	(4)	(5)	(6)
ln(travel distance)	0.102*** (0.0126)	0.162*** (0.0175)	0.161*** (0.0156)	0.114*** (0.0132)	0.169*** (0.0170)	0.167*** (0.0143)
R2017	0.213*** (0.0137)	1.163*** (0.188)	1.113*** (0.178)	0.223*** (0.0137)	1.183*** (0.189)	1.147*** (0.180)
R2018	0.0140 (0.0139)	0.294 (0.209)	0.201 (0.208)	0.0175 (0.0132)	0.277 (0.217)	0.173 (0.222)
RGS2017	-0.0865*** (0.0131)	1.417*** (0.210)	1.336*** (0.193)	-0.0778*** (0.0134)	1.492*** (0.227)	1.418*** (0.212)
R2017 × ln(travel distance)		-0.110*** (0.0229)	-0.107*** (0.0217)		-0.111*** (0.0232)	-0.110*** (0.0218)
R2018 × ln(travel distance)		-0.0149 (0.0236)	-0.00948 (0.0226)		-0.0129 (0.0246)	-0.00631 (0.0243)
RGS2017 × ln(travel distance)		-0.177*** (0.0248)	-0.170*** (0.0229)		-0.186*** (0.0274)	-0.180*** (0.0255)
R2017 × homeownership rate		-0.0777 (0.0572)	-0.0458 (0.0585)		-0.0877 (0.0565)	-0.0520 (0.0577)

(Continues)

TABLE A7 (Continued)

	(1)	(2)	(3)	(4)	(5)	(6)
R2018 × homeownership rate		-0.380*** (0.0498)	-0.331*** (0.0487)		-0.375*** (0.0505)	-0.325*** (0.0497)
RGS2017 × homeownership rate		-0.0980* (0.0497)	-0.0726 (0.0465)		-0.0941* (0.0493)	-0.0672 (0.0457)
Share foreigners			0.0352 (0.341)			0.0487 (0.342)
Density			0.0000848** (0.0000354)			0.0000845** (0.0000355)
Turnout federal election			0.142 (0.308)			0.153 (0.313)
Constant	-0.424*** (0.106)	-0.953*** (0.155)	-1.327*** (0.292)	-0.527*** (0.111)	-1.010*** (0.150)	-1.393*** (0.291)
N	224	224	224	224	224	224
F	161.6	171.9	155.7			
$\chi^2$				691.8	1613.9	1957.5
$R_w^2$	0.791	0.895	0.902	0.789	0.895	0.902
$R_b^2$	0.00129	0.382	0.203	0.00129	0.383	0.207
$R_o^2$	0.624	0.819	0.318	0.614	0.819	0.323
AR $\chi^2(3)$				68.13	90.05	91.56

Note: (1) FE, (2) FE, (3) FE, (4) IV-FE, (5) IV-FE, and (6) IV-FE.

Heteroscedasticity robust standard errors in parentheses.

Abbreviations: AR, Anderson–Rubin; FE, fixed effect; IV-FE, instrumental-variable fixed effect.

\* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ .

TABLE A8 FE and IV-FE regression for R2017 and RGS2017

	FE	IV-FE
RGS2017	0.272** (0.110)	0.304** (0.124)
ln(travel distance)	0.0210 (0.0144)	0.0106 (0.0180)
RGS2017 × ln(travel distance)	-0.0702*** (0.0135)	-0.0741*** (0.0151)
Constant	0.435*** (0.114)	0.518*** (0.142)
N	112	112

TABLE A8 (Continued)

	FE	IV-FE
<i>F</i>	470.0	
$\chi^2$		1531.9
$R_w^2$	0.959	0.958
$R_b^2$	0.0272	0.0144
$R_o^2$	0.853	0.848

Note: Heteroscedasticity robust standard errors in parentheses.  
Abbreviations: FE, fixed effect; IV-FE, instrumental variable fixed effect.  
\**p* < 0.1; \*\**p* < 0.05; \*\*\**p* < 0.01.

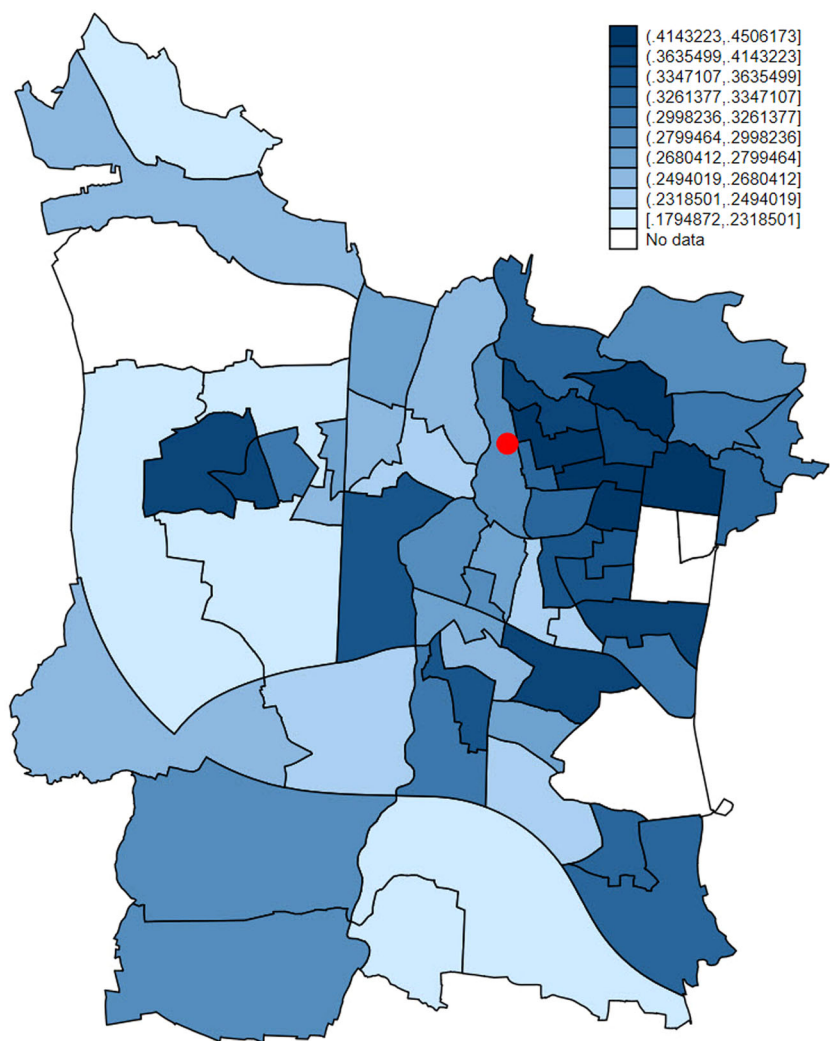


FIGURE A3 Shares of 'yes' votes of referendum RGS2017. Note: Voting-district shares of the votes in favor of development in referendum RGS2017; the location of the planned State Garden Show marked by red dot