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Voting on Urban Land Development

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Voting on Urban Land Development

Abstract

In this paper, we analyze several local referendums on land development and land-use regulation in the City of Erlangen (Germany) in the period between 2011 and 2018. To identify the positive influence of the travel distance on approval for the development of land, we employ a two-way fixed-effects model and use spatial instruments. Also, we analyze the heterogeneity of city dwellers' preferences for the development of residential and commercial areas. In particular, we examine the homeownership and expenditure-crowding-out hypotheses.

JEL-Codes: D720, R520, R580.

Keywords: land development, referendum, local public goods, distance decay, homeownership, expenditure-crowding out.

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1 Introduction

To adapt to demographic and economic changes, cities need to change land uses and develop fallow land. In referendums and local elections, as well as through 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 determine the direction and magnitude of the impacts by analyzing referenda on urban development projects in the City of Erlangen (Germany).

In developed countries, the population and urban areas are growing rapidly. Positive agglomeration effects on the labor and goods markets, in production, and in consumption attract firms and individuals to the urban areas (Rosenthal and Strange 2004; Combes and Gobillon 2015) and raise the demand for housing and space there. 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 (for the homevoter hypothesis and empirical evidence, see, e.g., Brueckner and Lai 1996; Fishel 2001; Brunner and Sonstelie 2003; Hilber and Mayer 2009). Higher competition on housing and labor markets, however, is at the expense of the established 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, as well as by the expansion of public infrastructure, in political practice, it is usually impossible to fully compensate all losers.

In some countries and regions, green belts around the cities or natural areas are legally protected (see, e.g., on the green belt around London, Amati and Yokohari 2007), which makes district extensions of cities even more difficult. Also if the area reservoir of the respective city is already completely exhausted and neighboring communities are affected, decision-making processes and compensations become more complex and time-consuming.

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).[1] 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).

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 queried in surveys before or after the election process. The aggregated voting behavior, however, is recorded at the voting district level. If the voting area is subdivided into many constituencies, it is possible to draw conclusions about parameters which are decisive for the evaluation by the voters from the relationship between voting results and characteristics of the electoral districts. At the voting district level, the influence of sociodemographic factors and geographical features, such as the distance between the district and the development area, can be determined. However, 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 (see, e.g., Gotway and Young 2002).

Moreover, the identification of individual determination factors for the choice decision

[1]For causes and effects, see Glaeser and Ward (2009); Hilber and Robert-Nicoud (2013); Gyourko and Molloy (2015).

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 for areas of a different geographical format selected for statistical purposes, which might be 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.

Related empirical literature: First, based on surveys, various studies have examined the individual attitudes towards land development projects. Since these studies evaluate surveys, they are not subject to the 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. Examining data from a national survey in the UK, Coelho et al. (2017) conclude that owner-occupiers tend to express greater opposition to local house building. Hankinson (2018) conducted a factorial survey in the US and a standard survey in San Francisco, where he found that homeowners are sensitive to housing's proximity, but renters only in the high-rent city San Francisco, which he interpreted as evidence for context sensitivity. The factorial survey enables the identification of 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 the majority of voters supported the sports arena, but voters in proximity of the proposed site opposed the project. Coates and Wicker (2015) investigated the 2018 referendum on Winter Olympics in Munich 2018 and found a more positive attitude toward the Munich Olympic bid in rural areas than in urban areas. Considering referendums on professional sports facilities in two different states in the US, 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 of a neighborhood more strongly than tenants. Because these studies analyze only one referendum at a time, 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 level of pollution, which most likely have an impact on voting decisions. Third, just 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 her study is based on repeated cross-sectional analyses and not on a longitudinal study, she was unable to control for the time-invariant unobservable characteristics of respondents. Due to the long period, changes in the underlying relationships may distort the results. Her study is not concerned with local level voting. The lower expected impact on the outcome might produce different results than would be 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 in that time voters often support measures that allow new development.

In this paper, we will examine referendums in the City of Erlangen (Germany) on the development of former agricultural land and densification of residential areas in the years 2011, 2017, and 2018. In 2011, the development of a commercial park in the southeast of the city was put to the vote. In 2017, residents voted on the 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. At the center of the analysis is the influence of the distance between the district and the project area on the consent to the area development or densification. Proximity largely determines the individual assessment of an urban development project, since the accessibility of green areas, congestion on traffic routes, concerns about parking spaces and traffic, visibility of buildings, and noise and air pollution vary widely with travel distance or Euclidian distance. Our main focus is on travel distance, but we also consider Euclidian distance.

Although we also analyze votes separately, our first main specification is a two-way fixed-effect analysis of all mentioned polls. 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 location and characteristics of the development project. The fixed-effects approach assumes that preferences are stable over time and votes. However, Erlangen, with a little more than 100,000 inhabitants, is characterized by a strong population turnover. From 2010 to 2016, an average of 9,302 people moved into the city each year, 8,182 people moved away, and 6,615 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 sociodemographic variables and preferences are stable, despite the changing composition of the population.

The main variable of interest in this study is the 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 causal effect of distance on approval rates because the development projects are located at different geographical points. For every voting district, distance varies over the votes (and for every project over the voting districts). Our research design enables us to identify the effect of distance on the approval rate if the following assumptions hold:

- The politicians have not selected the projects in such a way that they are systematically in lesser or greater distance from the residences of opponents or proponents of such projects.
- Opponents or proponents have not selected their residences in such a way that they are systematically in lesser or greater distance from the development projects.
- As far as travel distances are concerned, 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 socio-demographics and area characteristics that substantially affect voting.

The first assumption is likely to 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 the appendix). A targeted selection of locations determined by the spatial distribution of consent, and thus reverse causality, therefore seems unlikely. The second assumption will probably also hold since the development projects are spread over the city area. Moreover, for ordinary citizens, it is difficult to forecast locations and timing of projects well in advance. The third assumption holds only approximately because every year, smaller construction measures are implemented, which influence the optimal routing choice. 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 data, the fourth assumption might also be violated.

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 order to identify the causal effect if distance on approval, 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 instrumental variable.

In addition to distance and project characteristics, in this paper, we also examine the heterogeneity of consent between different social groups, especially between homeowners and tenants, and between recipients of social transfers and nonrecipients. Finally, the risk of ecological fallacy is particularly addressed in this study by comparing regressions for different area sizes.

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. We also demonstrate a negative association between the share of social welfare recipients and approval to land development projects and provide some evidence that – as compared to residential area projects – the share of homeowners and approval ratings of commercial area projects are more positively correlated. Furthermore, we show that the importance of distance varies across different measures. The travel distance has a slightly stronger effect on the consent to a commercial area than on the consent to some residential development projects.

The paper is organized as follows. Section 2 discusses the theoretical background. Section 3 presents the data and institutional background. Then, Section 4 develops the empirical model, and Section 5 describes the results. Section 6 draws conclusions from these findings.

2 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 explanatory variables of the model. The land proposed for development is currently used for agriculture, but the cultivated landscape also provides some benefits for ordinary citizens and visitors.[2] The land has an existence utility for the inhabitants of the City of Erlangen, which is lost as a result of the development. Since the areas under consideration are surrounded or crossed by publicly accessible paths, the areas also have utility as recreational areas, which depends on accessibility. The loss of utility will, therefore, 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

[2] 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 many citizens as a monument to the city's history.

cases, owners and users are not the same people. As the value of the land increases significantly with the change in the rights of use, landowners generally benefit from a change in use. This might not apply if in the course of development expropriations or "forced" sales occur, and the remaining farm size is no longer profitable. The leaseholders of agricultural land that is becoming building land are clearly losers of land-use change and, therefore, in the political process, also particularly committed opponents of such changes. In the case of 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 represent only a small minority of the population of the city, which can not directly affect the outcome of a vote. However, indirectly, those affected will have a significant impact on voting results via lobbying activities due to their pronounced financial interests.

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 direct neighbors.

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

Developments are associated with additional expenses for the municipality. Transport links, access to supply networks, and social infrastructure must be built and financed. Part of this expenditure only occurs during the development phase, while another part is permanent. Additional urban spending is at the expense of other urban tasks. In particular, recipients of municipal social benefits must fear the expenditure competition by the area development.

On the other hand, residential and commercial areas also have a positive effect on municipal revenues; property tax and trade tax revenues rise. The increase in the number of inhabitants of the city also increases income from the municipal fiscal equalization scheme of the federal state of Bavaria and from the municipal share of income tax revenue. If the City of Erlangen succeeds in attracting people with above-average income for living in the new residential areas, then the medium-term fiscal net effect of a residential area will be positive. The effects of a business park also depend on the characteristics of the new businesses. If these companies strengthen positive agglomeration effects and employ highly skilled people, the effects on the labor market and local finances should be noticeably positive. If, on the other hand, it is only possible to locate logistics companies that employ few staff on a large area, the fiscal and labor market effects are probably small. The economic situation in the City of Erlangen, however, suggests that innovative companies with highly-skilled workers would move to the new business parks, so that noticeable positive effects can be assumed.

In summary, these theory-based considerations make it clear that the geographical distance between the location of the project and the constituency, the ownership rate and the share of recipients of municipal social benefits, as well as the nature of the project, have an impact on the level of agreement in the constituency. We suspect that distance has a positive effect on the approval and that this 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 approval of business parks (homeownership hypothesis) and that the share of beneficiaries of urban social services will negatively impact approval of projects of all types (expenditure crowding-out hypothesis).

3 Institutions and data

The City of Erlangen has about 110,000 inhabitants and is the eighth largest city in the state of 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" as well as 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, the development of a commercial park in the south-east of the city was put to the vote (R2011). In 2017, there was a vote on the densification 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.

Data on voter turnout, on election results, but also 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.[3] The sociodemographic data are not available at the level of voting districts, but at the level of statistical districts, which are often larger, and in some cases, overlapping.[4] We assign the data of the statistical districts to the voting districts in proportion to the built-up areas weighted by eligible voters per m^2.[5] The spatial delineation of electoral districts changes slightly over time and differs

[3]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.

[4]For December 31, 2018 the department of statistics and city research provided for the first time sociodemographic data at the level of voting districts.

[5]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,μ 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 Goodchild and Lam 1980; Arntz and Wilke 2007). To avoid distortions due to large contiguous uninhabited areas, we link personal data on the basis of built-up areas instead of the total between the votes that are held separately and the votes that are held at the same time as a state election. The referendums R2011 and R2017 were carried out separately, the referendum R2018 at the same time as 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; therefore, the number of voting districts of the referendum R2017 was 57. For the state election and the referendum R2018, the city was divided into 97 voting districts. For the baseline analysis, all data will be converted to 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 in separate elections (of which demarcation is also used for European elections).

Our voting outcome of interest is the proportion of 'yes' votes among all valid votes. Due to the simultaneous state election, the turnout in 2018 was significantly higher than in 2011 and 2017. Table 1 shows voting outcomes.

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 south-east, R2011; in the center, R2017; in the west, R2018).

Our preferred measure of distance is travel distance (in meters). Alternatively we measure distance (in meters) as Euclidean distance between the centroids of the respective

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 from one street to the other.

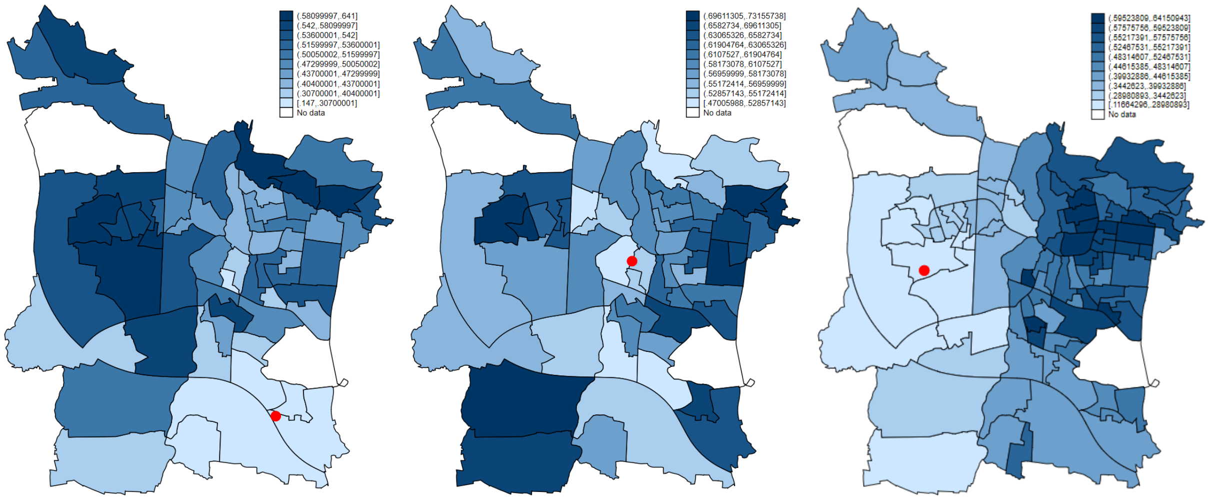

Figure 1: Shares of 'yes'-votes of referendums R2011, R2017, and R2018

areas.[6] Both strongly correlated distance measures can theoretically be justified: the impact of additional traffic and demand for parking space as well as the lost recreational benefits will vary with travel distance; however, the effects of different forms of pollution (visual, air, and noise pollution) change with the Euclidean distance.[7]

Since data on the homeownership rate are not publicly available, we use the proportion of detached and semi-detached houses among all houses as proxy for the homeownership rate. The proportion of rented units among detached and semi-detached houses is much lower than the proportion of rented units among all units. Because the proportion of detached and semidetached houses is correlated with population density, we control for density (inhabitants per km^2). To capture dependency on municipal social transfers, we use

[6]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 a 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.

[7]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.

the proportion of recipients of social transfers among all persons in employable age. This group makes up a large proportion of all recipients of social benefits. Cities like Erlangen are paying the costs of housing and heating for this group and determine the maximum refundable amount. In some regressions, we take various sociodemographic variables into account. We take the share of the elderly (65 years old and older), the share of females, and the share of foreigners in the population into consideration. In addition, the share of singles and the share of single-parents account for the composition of households. To take into account the geographic location in the city, we use the Euclidean distance between the centroid of the electoral district and the city center. Tables 5 and 6 in the appendix show summary statistics for 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.

4 Empirical model

To examine the effects on the voting behavior of distance, homeownership, and dependency on municipal social benefits, we do cross section and panel analyses. To compare residential area and commercial area projects, we rely on the panel. The two dimensions of the panel are voting districts and referendums. As mentioned, our voting outcome of interest is the proportion of 'yes' votes among all valid votes. We regress the voting outcome on the log of distance between the voting district and the project site and various other variables (proxy for homeownership, dependency on municipal social benefits, etc.). Our main focus is on travel distance, but we also consider Euclidian distance.

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

$$y_i = \alpha_0 + \alpha_1 d_i + \alpha_2 h_i + \alpha_3 s_i + \alpha_{\mathbf{4}} \mathbf{X_i} + \epsilon_i \, , \tag{1}$$

where i indicates the voting district, y_i the voting outcome in voting district i, d_i the log of 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, s_i the indicator of the share of voters depending on municipal social transfers in district i, $\mathbf{X_i}$ the vector of sociodemographic controls in district i, and ϵ_i the error term.

As discussed in Section 2, we hypothesize that distance has a positive effect on the approval rate ($\alpha_1 > 0$). According to the expenditure-crowding-out hypothesis, the coefficient of the proportion of social benefit recipients, s_i, should be negative ($\alpha_3 < 0$). 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 of the distance to the city center and density. As the impact of a development project increases, the benefits of electoral participation increase, so voters with higher opportunity costs will also vote. As a result, the composition of the actually voting population changes relative to the composition of the population eligible to vote. To take account of these effects, we control for voter turnout. Furthermore, we control for age structure, gender balance, household composition, and nationality.

The estimation equation in the panel analysis is:

$$y_{ij} = \beta_0 + \beta_1 d_{ij} + \beta_2 \gamma_j d_{ij} + \beta_3 h_{ij} + \beta_4 \gamma_j h_{ij} + \beta_5 s_{ij} + \beta_{\mathbf{6}} \mathbf{X_{ij}} + \delta_i + \gamma_j + \mu_{ij} \, , \qquad (2)$$

where j indicates the referendum, δ_i the voting-district-fixed effect, γ_j the referendum-fixed effect, and μ_{ij} the error term.

In analogy to the cross sections, we expect that the coefficient of distance, d_i, is positive, and the coefficient of social transfer recipients, s_i, 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, $\gamma_j d_{ij}$, should be negative when the reference category is the referendum on commercial project.

Because we cannot completely rule out that travel distance is correlated with the error term, to identify the effect of travel distance, 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 district (Krause 1986). The taxicab distance is imperfectly related to the Euclidian distance via the Pythagorean theorem and, thus, most likely a strong instrument. In Figure 2 (left part), the Euclidian distance is the same for locations A and B, whereas the taxicab distance is larger for B than for A. Figure 2 (right part) shows the relationship between the east-west distance and the difference between taxicab distance and Euclidian distance for a fixed level of Euclidian distance (right). Furthermore, as the Euclidean distance increases, but the direction does not change, so does the taxicab distance. It can be argued that visibility and pollution levels vary systematically with the Euclidian distance, but there is no good reason to believe that these parameters are closely related to the taxicab distance. Finally, Erlangen is not a planned city in a checkerboard pattern. Hence, it is rather plausible that the exclusion restriction holds.

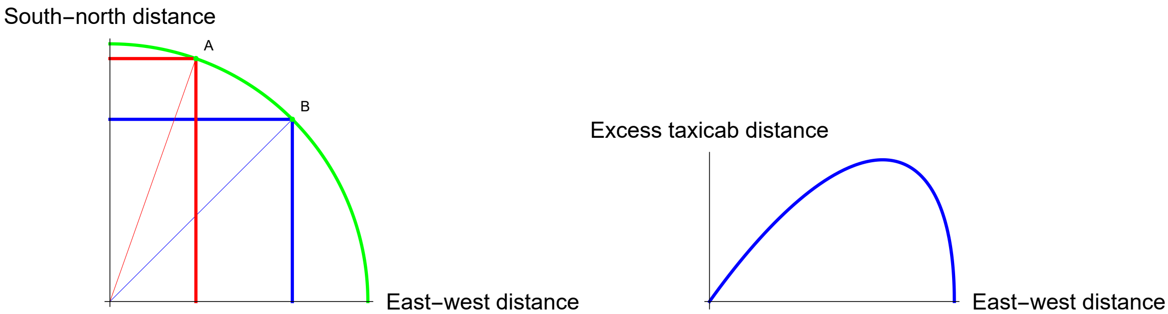

Figure 2: Taxicab distance vs Euclidian distance

5 Results

We consider the proportion of 'yes' votes among all valid votes as the voting outcome.

Tables 2 and 3 show the results of cross-section analyses (OLS and IV) for the three referendums without and with co-variates other than distance. Since we have little control in cross-sections over sociodemographic influences, an omitted-variable bias is very 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.[8] Interestingly enough, for the densification project 2017 distance accounts for a much smaller share of variance than for the other two projects, for which agricultural land is to be developed for commercial or residential use.

[8]As expected, the instrument is strong: the F statistics of the first stage is in any case above standard thresholds.

However, the weaker effect of the distance to the project may be due to the fact that these estimates control for the distance to the city center and that the development project in 2017 is not far from the center. Not only is the distance coefficient for all projects positive, it is also larger for the business park project than for the other two projects. However, only the difference between the coefficients for the commercial project R2011 and the densification project R2017 is statistically significant (for OLS, $\chi^2 = 4.24$). Hence, also the second part of the distance hypothesis is partially confirmed. Furthermore, the coefficient of our proxy for homeownership is negative for the residential projects, but not different from zero for the commercial project; the differences between the coefficients are not statistically significant. These differences indicate that the homeownership hypothesis holds. Finally, unlike what the expenditure-crowding-out hypothesis would have suggested, there is no statistically significant relationship between the share of social transfer recipients and the approval rate.

Tables 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.[9] Fixed-effects and instrumental-variable-fixed-effect regression are quite similar.

Both types of fixed-effect regressions strongly confirm the main distance hypothesis and the expenditure-crowding-out hypothesis. The coefficient of distance, d_i, is positive and the coefficient of social transfer recipients, s_i, is negative, both 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 when we include all controls). For R2018, this result does not hold; the coefficient of the interaction term is not statistically significant when controls are included. The homeownership hypothesis is partially supported by the data. The coefficient of the interaction term of the referendum-fixed effect and homeownership, $\gamma_j d_{ij}$, is negative for R2017 and R2018, but statistically

[9]According to the Anderson-Rubin (AR) test statistic, the instruments are strong. The AR test statistic is provided by the Stata module *weakiv* from Finlay et al. (2013).

significant only for the land development project in 2018.

Table 2: OLS and IV regressions for R2011, R2017 and R2018 (a)

	(1)	(2)	(3)	(4)	(5)	(6)
ln(travel distance)	0.165***	0.0329***	0.179***	0.167***	0.0423***	0.210***
	(0.0151)	(0.00955)	(0.0210)	(0.0154)	(0.0100)	(0.0225)
Constant	−0.977***	0.340***	−1.062***	−0.992***	0.265***	−1.326***
	(0.135)	(0.0722)	(0.177)	(0.137)	(0.0762)	(0.191)
N	56	56	56	56	56	56
F	118.5	11.89	72.67			
chi2				116.4	17.71	86.67
r2	0.622	0.104	0.502	0.622	0.0952	0.487
r2_a	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

(1): R2011 OLS, (2): R2017 OLS, (3): R2018 OLS, (4): R2011 IV, (5): R2017 IV, (6): R2018 IV
Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 3: OLS and IV regressions for R2011, R2017 and R2018 (b)

	(1)	(2)	(3)	(4)	(5)	(6)
ln(travel distance)	0.174***	0.0680***	0.154***	0.178***	0.0841***	0.166***
	(0.0538)	(0.0213)	(0.0163)	(0.0460)	(0.0207)	(0.0161)
share social transfer recipients	−0.106	0.354	0.149	−0.109	0.320	0.231
	(0.284)	(0.253)	(0.398)	(0.252)	(0.235)	(0.349)
share semi-/detached houses	0.0534	−0.134**	−0.106**	0.0573	−0.135**	−0.106**
	(0.155)	(0.0658)	(0.0515)	(0.139)	(0.0579)	(0.0464)
density	0.00000339	0.0000152***	0.00000712**	0.00000344	0.0000156***	0.00000747**
	(0.00000569)	(0.00000354)	(0.00000327)	(0.00000509)	(0.00000328)	(0.00000298)
turnout	−0.0111	0.465***	−0.116	0.00682	0.511***	−0.0950
	(0.271)	(0.158)	(0.177)	(0.230)	(0.147)	(0.154)
ln(distance city center)	0.00282	0.00725***	0.00148	0.00287	0.00713***	0.00113
	(0.00283)	(0.00182)	(0.00315)	(0.00262)	(0.00153)	(0.00295)
share age group ≥ 65	0.201	−0.142	−0.351*	0.204	−0.138	−0.343**
	(0.146)	(0.130)	(0.177)	(0.131)	(0.116)	(0.151)
share females	−0.505	−0.712**	1.165**	−0.506*	−0.634**	1.083**
	(0.322)	(0.337)	(0.520)	(0.287)	(0.313)	(0.475)
share singles	−0.0693	−0.404**	0.0169	−0.0635	−0.381***	−0.000938
	(0.247)	(0.158)	(0.147)	(0.217)	(0.142)	(0.134)
share single parents	−0.634	−4.984**	−4.959*	−0.576	−4.403**	−5.052**
	(2.518)	(2.329)	(2.480)	(2.229)	(2.177)	(2.133)
share foreigners	0.335	0.361	0.414	0.357	0.480**	0.412*
	(0.560)	(0.231)	(0.269)	(0.518)	(0.225)	(0.238)
Constant	−0.913	0.372	−1.275***	−0.956	0.155	−1.346***
	(0.734)	(0.353)	(0.330)	(0.638)	(0.345)	(0.294)
N	56	56	56	56	56	56
F	13.98	5.237	48.64			
chi2				193.9	75.51	698.2
r2	0.644	0.543	0.884	0.644	0.537	0.883
r2_a	0.555	0.429	0.855	0.555	0.421	0.853
rmse	0.0676	0.0463	0.0457	0.0600	0.0414	0.0408
First-stage F(1,44)				121.552	173.75	218.586

(1): R2011 OLS, (2): R2017 OLS, (3): R2018 OLS, (4): R2011 IV, (5): R2017 IV, (6): R2018 IV
Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4: FE and IV-FE regressions for R2011, R2017 and R2018

	(1)	(2)	(3)	(4)	(5)	(6)
ln(travel distance)	0.105***	0.138***	0.148***	0.140***	0.127***	0.168***
	(0.0295)	(0.0270)	(0.0273)	(0.0338)	(0.0313)	(0.0308)
R2017	0.422*	0.728***	0.784***	0.638***	0.590***	0.814***
	(0.229)	(0.201)	(0.197)	(0.247)	(0.222)	(0.218)
R2018	−0.623**	−0.177	−0.194	−0.571*	−0.400	−0.260
	(0.272)	(0.260)	(0.257)	(0.310)	(0.298)	(0.305)
share social transfer recipients	−1.676***	−1.397***	−1.112***	−1.559***	−1.413***	−1.188***
	(0.518)	(0.415)	(0.411)	(0.547)	(0.425)	(0.423)
share semi-/detached houses	−1.522	−1.755**	−2.731***	−1.519	−1.545*	−2.782***
	(1.119)	(0.845)	(0.783)	(1.137)	(0.882)	(0.792)
density	0.000105***	0.0000423	0.0000476	0.000109***	0.0000426	0.0000325
	(0.0000316)	(0.0000293)	(0.0000391)	(0.0000332)	(0.0000291)	(0.0000385)
turnout	−0.324**	−0.144	−0.105	−0.168	−0.172	0.0208
	(0.149)	(0.124)	(0.147)	(0.176)	(0.146)	(0.169)
R2017 × ln(travel distance)	−0.0223	−0.0578**	−0.0696***	−0.0491	−0.0398	−0.0727***
	(0.0280)	(0.0245)	(0.0240)	(0.0299)	(0.0268)	(0.0268)
R2018 × ln(travel distance)	0.0864**	0.0411	0.0357	0.0743*	0.0675*	0.0360
	(0.0365)	(0.0327)	(0.0321)	(0.0419)	(0.0376)	(0.0379)
R2017 × share semi-/detached houses		−0.0598	−0.0768		−0.0726	−0.105
		(0.0495)	(0.0648)		(0.0502)	(0.0651)
R2018 × share semi-/detached houses		−0.202***	−0.226***		−0.194***	−0.215***
		(0.0566)	(0.0667)		(0.0564)	(0.0685)
R2017 × density		0.00000782*	0.00000835*		0.00000773*	0.00000976**
		(0.00000452)	(0.00000423)		(0.00000455)	(0.00000427)
R2018 × density		0.00000852*	0.00000910*		0.00000879**	0.0000111**
		(0.00000441)	(0.00000465)		(0.00000439)	(0.00000456)
share age group ≥ 65			−0.141			−0.0594
			(0.427)			(0.447)
share females			−1.121			−1.096
			(0.923)			(0.963)
share singles			1.177**			1.139**
			(0.510)			(0.512)
share single parents			−6.476***			−6.088***
			(1.776)			(1.829)

continued on next page

Table 4 – continued from previous page

	(1)	(2)	(3)	(4)	(5)	(6)
share foreigners			0.420			0.631
			(0.408)			(0.431)
Constant	0.385	0.415	1.344**	0.0332	0.377	1.184*
	(0.784)	(0.627)	(0.648)	(0.816)	(0.643)	(0.624)
N	168	168	168	168	168	168
F	106.3	105.2	72.65			
chi2				798.8	1477.3	1185.9
r2_w	0.835	0.876	0.898	0.831	0.875	0.896
r2_b	0.313	0.328	0.305	0.316	0.335	0.304
r2_o	0.164	0.188	0.129	0.169	0.205	0.131
df_m	8	12	17	65	69	74
AR chi2(3)				63.37	54.01	57.43

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

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Robustness To get an idea of how strongly the conversion of the data into the constituency structure of 2011 influences the results, we estimate the OLS model for the referendum R2018 also for the original 97 electoral districts and compare the two cross-sections (see Table 7 in the appendix). The overall explanatory power of the model does not increase, and also the coefficient of travel distance does not change by much. Hence, the distance hypothesis is again confirmed. Probably because the share of semi-/detached houses and density are strongly correlated, the statistical significance of the former shrinks as the statistical significance of the latter increases. Otherwise, the results are quite similar. We interpret the similarity of the results as an indication that the problem of ecological fallacy is relatively minor.

In addition, we looked at Euclidian distance which turns out to have quite similar effects (results not shown in the paper).

We also examined voter turnout data, where we find on average a negative effect of distance on voter turnout (see Table 8 in the appendix). For residential projects, the effect of distance is less negative; for the referendum R2018, it is even close to zero. With an average distance from the project location, the approval for the residential projects is greater than the approval for the business park. The closer the voting district is to the respective project location, the smaller this difference. Since foreigners with a 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.

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 the 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 referendum RGS2017. Wording, descriptive statistics (Table 9), shares of 'yes'-votes (Figure 4), and regression results (Table 11) are shown in the appendix. These fixed-effect and instrumental-variable-fixed-effect regressions confirm our previous results. The coefficient of distance is positive and the coefficient of social transfer recipients is negative. The home-ownership hypothesis is only partially supported by the data. Interestingly, if we include interactions and controls, distance has a negative effect on approval rates for the garden show. This result probably reflects the fact that the residents of the outskirts districts fear to lose 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 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 10 in the appendix for fixed-effect and instrumental-variable-fixed-effect regressions).

6 Conclusion

In this paper, we analyzed several local referendums on the development of land and land-use regulation in the City of Erlangen (Germany) in 2011, 2017, and 2018. Employing a two-way fixed effects model, we were able to demonstrate the positive influence of the distance on the approval of land development, which particularly strong for business parks. We introduced a new spatial instrument for travel distance and confirmed this result with an instrumental-variable estimation. We documented that social welfare recipients strongly oppose municipal land development presumably because they expect that the city is going to increase infrastructure expenditure at the expense of social spending (the expenditure-crowding-out hypothesis). Furthermore, we showed that, as compared to some residential development projects, homeowners have a stronger preference for the development of commercial areas than renters (homeownership hypothesis).

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Appendix

The wording of the referendums

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?

Referendum "ERBA settlement" on May 7, 2017 (R2017)

Are you in favor of the City of Erlangen withdrawing the decision of GEWOBAU for demolishing the historic buildings of Äußere Brucker Straße 82, 84, 86/88, Mainstraße 1 and Johann-Jürgen-Straße 1-7 by all legally permissible means, with the goal of sustainable refurbishment and sustainable preservation as a social housing estate with the associated gardens?

For consistency, we recode the votes of the referendum R2017, i.e., we recode the votes as if the wording were "Are you *not* in favor of the City of Erlangen withdrawing the decision of GEWOBAU for demolishing the historic buildings of Äußere Brucker Straße 82, 84, 86/88, Mainstraße 1 and Johann-Jürgen-Straße 1-7 by all legally permissible means, with the goal of sustainable refurbishment and sustainable preservation as a social housing estate with the associated gardens?"

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)?

Socio-demographic variables 2011 and 2018

Table 5: Summary statistics for the 56 voting districts in 2011

Variable	Mean	Std. Dev.	Min.	Max.
share semi-/detached houses	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 6: Summary statistics for the 56 voting districts in 2018

Variable	Mean	Std. Dev.	Min.	Max.
share semi-/detached houses	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

Areas available for land development

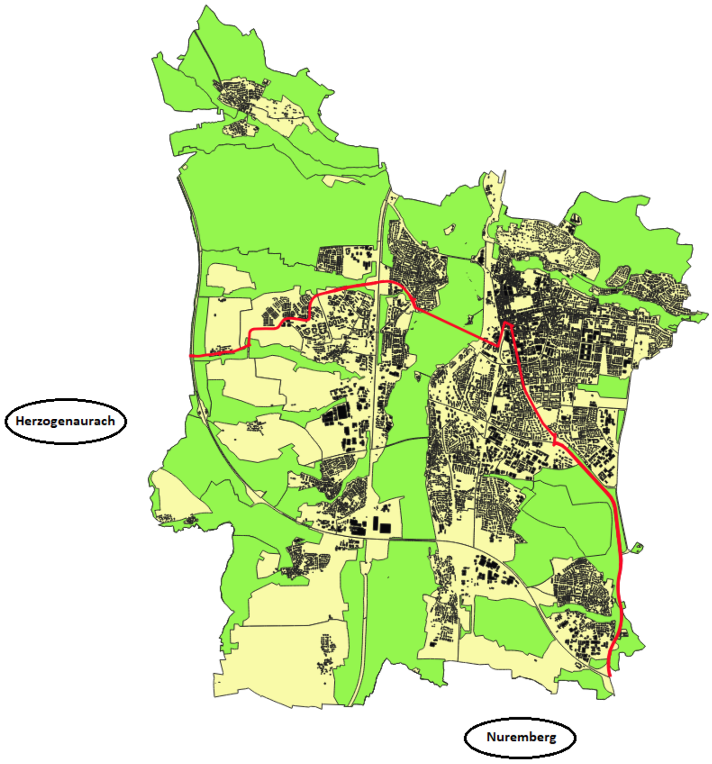

Figure 3: Land use in Erlangen

In Figure 3, the potentially available areas are light (yellow), the protected areas (protected areas, nature reserves) darker (green) and the buildings black. Only in the west, south-west and south-east are larger contiguous areas currently predominantly used for agriculture available for urban development projects. In addition, Figure 3 shows a projected tram line connecting Erlangen including the city center with Nuremberg (largest city in the region) and Herzogenaurach (headquarter of a DAX corporation). Due to the possible routing areas adjacent to the City of Erlangen as well as the travel times there is little room for maneuvering on the Erlangen urban area. Since a good connection to this tram and the city center for all development projects seems necessary, the area in the southwest of the city is currently out of the question for a development project. Thus, for larger development projects, only the areas in which the development projects of 2011 and 2018 are located remain. The area of the development project of 2018 was already included in an urban development plan of 1978 for development. Due to temporarily available conversion areas in the east of the city, these plans were initially postponed. After these areas in the east of the city were developed, the old plan was taken up again.

Further regressions

Table 7: OLS regressions for R2018 (56 vs 97 districts)

	56 districts	97 districts
ln(travel distance)	0.154***	0.155***
	(0.0163)	(0.0132)
share social transfer recipients	0.149	−0.0250
	(0.398)	(0.293)
share semi-/detached houses	−0.106**	−0.0806
	(0.0515)	(0.0609)
density	0.00000712**	0.00000922***
	(0.00000327)	(0.00000242)
turnout	−0.116	−0.107
	(0.177)	(0.0966)
ln(distance city center)	0.00148	0.000828
	(0.00315)	(0.00414)
share age group $\geq$ 65	−0.351*	−0.310***
	(0.177)	(0.113)
share females	1.165**	1.003**
	(0.520)	(0.406)
share singles	0.0169	−0.00681
	(0.147)	(0.123)
share single parents	−4.959*	−4.701**
	(2.480)	(2.072)
share foreigners	0.414	0.466**
	(0.269)	(0.190)
Constant	−1.275***	−1.235***
	(0.330)	(0.265)
N	56	97
F	48.64	60.70
r2	0.884	0.836
r2_a	0.855	0.815
rmse	0.0457	0.0515
df_r	44	85

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 8: Voter turnout: FE/IV-FE regressions (R2011, R2017, R2018)

	(1)	(2)	(3)	(4)	(5)	(6)
ln(travel distance)	−0.160***	−0.161***	−0.155***	−0.162***	−0.152***	−0.152***
	(0.0191)	(0.0202)	(0.0113)	(0.0177)	(0.0212)	(0.0113)
R2017	−1.039***	−0.913***	−0.796***	−1.000***	−0.757***	−0.738***
	(0.174)	(0.178)	(0.130)	(0.162)	(0.175)	(0.134)
R2018	−1.043***	−1.004***	−0.757***	−0.974***	−0.807***	−0.676***
	(0.207)	(0.218)	(0.169)	(0.195)	(0.225)	(0.168)
share social transfer recipients	−0.418	−0.340	0.397*	−0.428	−0.326	0.413*
	(0.258)	(0.291)	(0.235)	(0.269)	(0.302)	(0.240)
share semi-/detached houses	0.775*	1.028	1.500***	0.648	0.789	1.409***
	(0.453)	(0.630)	(0.452)	(0.429)	(0.577)	(0.454)
density	−0.0000169	0.0000254	0.0000952***	−0.0000187	0.0000245	0.0000959***
	(0.0000183)	(0.0000224)	(0.0000235)	(0.0000185)	(0.0000221)	(0.0000232)
R2017 × ln(travel distance)	0.135***	0.114***	0.107***	0.130***	0.0937***	0.0991***
	(0.0199)	(0.0221)	(0.0168)	(0.0187)	(0.0216)	(0.0175)
R2018 × ln(travel distance)	0.163***	0.159***	0.140***	0.155***	0.136***	0.131***
	(0.0233)	(0.0253)	(0.0183)	(0.0221)	(0.0260)	(0.0185)
R2017 × share semi-/detached houses		0.0817**	0.0559		0.102**	0.0656*
		(0.0406)	(0.0365)		(0.0416)	(0.0378)
R2018 × share semi-/detached houses		0.0232	−0.0309		0.0185	−0.0337
		(0.0332)	(0.0348)		(0.0346)	(0.0348)
R2017 × density		−0.00000767**	−0.00000839***		−0.00000777***	−0.00000848***
		(0.00000294)	(0.00000230)		(0.00000295)	(0.00000231)
R2018 × density		−0.00000726*	−0.00000955***		−0.00000746*	−0.00000971***
		(0.00000405)	(0.00000294)		(0.00000421)	(0.00000299)
share age group ≥ 65			0.0134			0.00268
			(0.244)			(0.248)
share females			−0.621			−0.639
			(0.498)			(0.512)
share singles			0.243			0.245
			(0.328)			(0.323)
share single parents			−2.070			−2.115
			(1.395)			(1.399)
share foreigners			−1.350***			−1.369***
			(0.168)			(0.172)

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Table 8 – continued from previous page

	(1)	(2)	(3)	(4)	(5)	(6)
Constant	1.133***	0.828*	0.647*	1.243***	0.908**	0.696*
	(0.334)	(0.441)	(0.363)	(0.320)	(0.407)	(0.362)
N	168	168	168	168	168	168
F	720.9	466.0	600.7			
chi2				4335.4	4880.2	8626.1
r2_w	0.973	0.977	0.985	0.973	0.976	0.985
r2_b	0.546	0.372	0.149	0.562	0.347	0.131
r2_o	0.664	0.581	0.295	0.718	0.675	0.298
df_m	7	11	16	64	68	73

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

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

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?”.

Table 9: Summary statistics for referendum RGS2017

Variable	Mean	Std. Dev.	Min.	Max.	N
yes	0.313	0.072	0.179	0.492	57
turnout	0.334	0.074	0.207	0.491	57

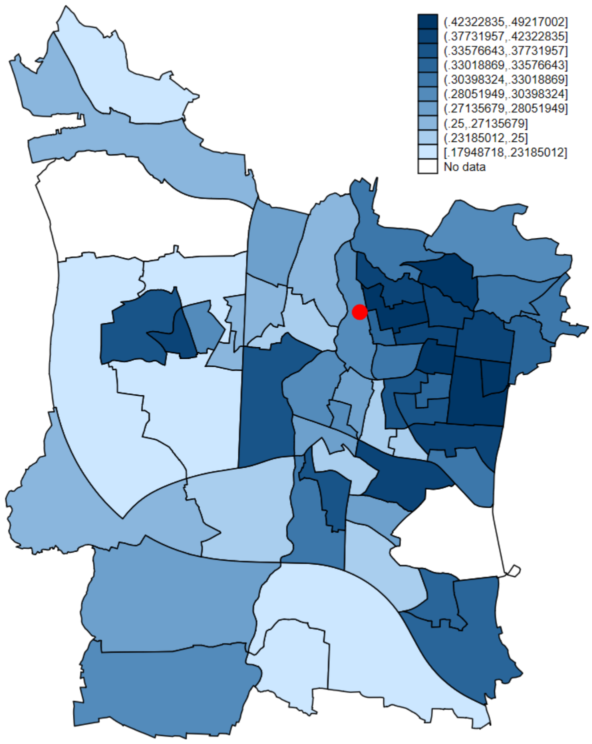

Figure 4: Shares of ‘yes’-votes of referendum RGS2017

Table 10: FE and IV-FE regression for R2017 and RGS2017

	FE	IV-FE
RGS2017	0.272**	0.304**
	(0.110)	(0.124)
ln(travel distance)	0.0210	0.0106
	(0.0144)	(0.0180)
RGS2017 × ln(travel distance)	−0.0702***	−0.0741***
	(0.0135)	(0.0151)
Constant	0.435***	0.518***
	(0.114)	(0.142)
N	112	112
F	470.0	
chi2		1531.9
r2_w	0.959	0.958
r2_b	0.0272	0.0144
r2_o	0.853	0.848
df_m	2	59

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 11: FE/IV-FE regressions (R2011, R2017, RGS2017, R2018)

	(1)	(2)	(3)	(4)	(5)	(6)
ln(travel distance)	0.101***	0.124***	0.121***	0.137***	0.132***	0.154***
	(0.0258)	(0.0226)	(0.0227)	(0.0266)	(0.0242)	(0.0251)
R2017	0.483**	0.766***	0.748***	0.745***	0.795***	0.928***
	(0.202)	(0.175)	(0.172)	(0.205)	(0.193)	(0.189)
R2018	−0.512**	−0.0886	−0.128	−0.418	−0.130	−0.0491
	(0.236)	(0.226)	(0.215)	(0.258)	(0.253)	(0.249)
RGS2017	0.711***	1.077***	1.061***	0.996***	1.142***	1.298***
	(0.228)	(0.232)	(0.239)	(0.236)	(0.249)	(0.261)
share social transfer recipients	−1.872***	−1.599***	−1.386***	−1.773***	−1.593***	−1.448***
	(0.439)	(0.358)	(0.413)	(0.446)	(0.361)	(0.414)
share semi-/detached houses	−2.092**	−2.140***	−2.783***	−2.241**	−2.181***	−3.128***
	(0.898)	(0.756)	(0.776)	(0.886)	(0.801)	(0.859)
density	0.000110***	0.0000645**	0.0000820**	0.000113***	0.0000625**	0.0000643
	(0.0000296)	(0.0000285)	(0.0000397)	(0.0000308)	(0.0000284)	(0.0000397)
turnout	−0.377***	−0.268**	−0.293**	−0.232	−0.232**	−0.137
	(0.131)	(0.102)	(0.125)	(0.143)	(0.111)	(0.148)
R2017 × ln(travel distance)	−0.0296	−0.0646***	−0.0664***	−0.0618**	−0.0678***	−0.0892***
	(0.0247)	(0.0214)	(0.0211)	(0.0250)	(0.0239)	(0.0241)
R2018 × ln(travel distance)	0.0754**	0.0361	0.0380	0.0588*	0.0388	0.0199
	(0.0318)	(0.0275)	(0.0264)	(0.0348)	(0.0310)	(0.0313)
RGS2017 × ln(travel distance)	−0.0948***	−0.138***	−0.140***	−0.130***	−0.146***	−0.171***
	(0.0278)	(0.0286)	(0.0287)	(0.0289)	(0.0312)	(0.0326)
R2017 × share semi-/detached houses		−0.0181	−0.0171		−0.0254	−0.0287
		(0.0457)	(0.0579)		(0.0481)	(0.0602)
R2018 × share semi-/detached houses		−0.202***	−0.216***		−0.195***	−0.203***
		(0.0546)	(0.0636)		(0.0561)	(0.0653)
RGS2017 × share semi-/detached houses		−0.0277	−0.0264		−0.0271	−0.0254
		(0.0549)	(0.0804)		(0.0538)	(0.0804)
R2017 × density		0.00000581	0.00000579		0.00000628	0.00000752*
		(0.00000427)	(0.00000391)		(0.00000428)	(0.00000394)
R2018 × density		0.00000616	0.00000588		0.00000700	0.00000827*
		(0.00000448)	(0.00000476)		(0.00000438)	(0.00000452)
RGS2017 × density		0.00000238	0.00000241		0.00000263	0.00000375
		(0.00000420)	(0.00000499)		(0.00000415)	(0.00000493)

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	(1)	(2)	(3)	(4)	(5)	(6)
share age group $\geq$ 65			-0.247			-0.136
			(0.370)			(0.364)
share females			-0.541			-0.547
			(0.905)			(0.891)
share singles			0.865*			0.788
			(0.483)			(0.477)
share single parents			-6.032***			-5.698***
			(2.028)			(2.066)
share foreigners			0.124			0.348
			(0.389)			(0.403)
Constant	0.810	0.758	1.375**	0.558	0.719	1.326*
	(0.658)	(0.601)	(0.682)	(0.649)	(0.589)	(0.712)
N	224	224	224	224	224	224
F	138.3	138.8	109.0	141.2	136.6	107.7
chi2						
r2_w	0.889	0.909	0.916	0.886	0.909	0.915
r2_b	0.316	0.316	0.318	0.316	0.317	0.312
r2_o	0.142	0.157	0.120	0.139	0.157	0.116
df_m	10	16	21	67	73	78

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

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

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