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Green Parties and Building Permissions: Evidence from Bavarian Municipalities

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Green Parties and Building Permissions: Evidence from Bavarian Municipalities

Abstract

This paper studies whether the rise of environmental parties during the last few decades can provide an explanation for reduced housing supply. Specifically, we examine the impact of Green Party presence on short-term housing supply in Bavarian municipalities from 1987 to 2019. Using a set of staggered difference-in-differences approaches and a large panel data set, we find that the entry of Green Party members into municipal councils leads to an approximate 5.6% decrease in the short-term issuance of building permits. Our results suggest that even in minority positions, Green Party members can influence local decision-making through highlighting the negative externalities associated with construction projects. Moreover, this influence may lead to policy convergence, where other parties adopt some elements of the Green Party's environmental agenda to appeal to environmentally conscious voters. Overall, our study contributes to understanding the trade-offs between housing supply and environmental protection in decentralized democratic settings and sheds light on the role of Green Party members in shaping local land use policy.

JEL-Codes: H73, H77, R31, R38, Q56

Keywords: Party effects; housing supply; land use policies; natural resources; difference-indifferences

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1 Patrick Hufschmidt, Technische Universität Dortmund. *– I am grateful for the valuable comments provided by my PhD supervisor, Thushyanthan Baskaran, and the participants of the doctoral seminars in the MAGKS program. I would also like to express my gratitude to the participants of the Public Finance Conference 2022 (ZEW, Mannheim) for their insightful feedback.* *– All correspondence to: Patrick Hufschmidt, Technische Universität Dortmund, Department of Economics, Öffentliche Finanzen, 44221 Dortmund, Germany, e-mail: patrick.hufschmidt@tu-dortmund.de.*

1 Introduction

Demand for green politics has been rising over the last few decades, as evidenced by both parliamentary and extra-parliamentary activities. This growing interest in environmental issues has manifested in various ways, including the rise of green parties around the world and the recent emergence of activist groups and movements, such as Extinction Rebellion in Great Britain or Letzte Generation in Germany.

The rise of these political forces demonstrates the growing public awareness and concern for environmental issues, as well as the increasing interest in political action to address the challenges posed by climate change, biodiversity loss, and other pressing ecological concerns.

One significant aspect of this issue pertains to the building sector, which is responsible for a considerable share of global CO_2 emissions, encompassing operational aspects such as heating, hot water, electricity, and air conditioning, as well as the construction process itself. According to estimations for the year 2019, the operation of buildings caused the release of 10 Gt of CO_2, resulting in 28% of total global energy-related CO_2 emissions. However, if emissions from the construction industry of buildings are taken into account, the proportion increases to 38% (GlobalABC, 2020). Moreover, research has highlighted a strong relationship between emissions and land use regulation for a sample of the United States (Glaeser and Kahn, 2010). These results emphasize the significance of the building sector and land use planning for achieving emissions reduction goals.

The urgency of sustainable urban development is increasingly recognized in the face of climate change, resource depletion, and rapid urbanization. Consequently, municipalities are called upon to transition towards low-carbon, resource-efficient, and resilient urban environments. Restrictive building policies have emerged as pivotal instruments in realizing this objective, with green parties playing a crucial role in advocating for environmental protection and sustainable development. However, the extent of their impact on shaping building policies warrants further investigation.

This paper aims to analyze the relationship between green parties and building policies within the context of an industrialized country. We chose Bavaria as our focus for three key reasons. First, Bavaria has the highest rate of land conversion to urban use in Germany, a topic that has been significant in recent elections and party platforms. Second, a unique feature of Bavaria is its municipal councils, which have considerably more decision-making power over building policies compared to other German states. This provides an ideal setting to explore the relationship between council composition and building permissions. Lastly, we have access to a large panel data set (1987-2019), primarily composed of official data, which ensures the validity of our results.

We employ a staggered difference-in-differences design and present evidence on the impact of Green Party presence on building permits. Specifically, we exploit the staggered seat gains of Green Party members in Bavarian elections at the municipality level since the early 1990s. By combining a rich data set at the municipality level, including information on population development, employment, public debt, house price development, and daytime satellite data on rural-to-urban land conversion, we find that the election of Green council members has a short-term negative effect on the issuance of building permits at the local level.

Utilizing the parallel trends assumption for prior elections at the municipal level, our approach allows us to derive causal estimates of Green Party presence in municipal councils and its impact on short-term building permits. Our empirical strategy effectively mitigates various confounding factors: First, we account for time-invariant, municipality-specific differences. For example, municipalities with historically protected districts due to cultural and architectural importance may impose stringent building regulations, limiting construction activities. As a result, the granted building permits in such municipalities could be lower than in others without these districts, regardless of the presence of Green Party council members. Second, our methodology considers time-varying factors that similarly influence all municipalities. Specifically, we incorporate time fixed effects, such as macroeconomic fluctuations which affect the entire state. An economic downturn, for instance, could reduce construction activities and building permits across all municipalities, irrespective of the presence of Green Party council members. Lastly, we include an extensive set of covariates reflecting various municipality-level dynamics, such as population, budgetary aspects, employment, and land cover development. By integrating these variables, we further refine the precision and robustness of our estimates of Green Party presence on short-term building permits. We also respond to recent econometric concerns related to staggered difference-in-differences research designs by adopting the methodology by Gardner (2022), which specifically addresses these challenges.

Our main finding is that the election of Green Party members into municipal councils leads to a decrease in residential building permits by approximately 5.6%. For an average municipality, this estimate equates to a reduction of between 2 and 3 permitted dwellings compared to the non-treated municipalities. We further observe three supplementary results. First, we find that the presence of the Green Party negatively impacts permissions for both residential and non-residential buildings, although the results for non-residential buildings are less robust. Second, we also observe a decrease in permitted living space and apartments accompanying the short-term reduction in building permissions. Third, our evidence suggests that municipalities with a Green mayor issue fewer permissions for residential buildings, indicating greater restrictiveness in such municipalities compared to their counterparts without mayors following an explicit environmentalist agenda. However, these additional results do not extend to non-residential

buildings, and their external validity is limited, given that only 24 municipalities in our sample were 'treated' by Green mayors.

How can we explain these negative effects on the short-run housing supply, as proxied by building permissions? We argue that the negative effects on short-term housing supply can be explained through the influence of Green Party members on local decision-making, even when they are not in majority positions. In a public economics framework, we can understand this by examining the process of collective decision-making and the role of externalities. Decisions regarding building permits and construction projects in a municipal council are typically made collectively, with representatives from different parties contributing to the decision-making process. Even without a majority, Green Party members can still influence these decisions by highlighting the negative externalities associated with construction projects, such as environmental degradation, loss of green spaces, and increased CO_2 emissions. These concerns can resonate with other council members, leading to a more cautious approach toward granting building permits.

The phenomenon of policy convergence or diffusion, where political parties adopt certain policy positions to align with shifting public opinion or to appeal to a wider range of voters, is well-documented (Alesina, 1988; Bennett, 1991; Abel, 2021). This conversion aligns with the general framework of the Median Voter Model, where parties adjust their positions to appeal to the median voter who prioritizes environmental protection. As such, other parties may incorporate elements of the Green Party's agenda in an attempt to appeal to environmentally conscious voters.

The results presented in this paper, derived from the staggered expansion of Green Party presence across Bavarian municipalities, should be interpreted with caution due to several reasons. First, our findings are primarily applicable to relatively rural municipalities with populations ranging from 1,000 to 20,000 inhabitants. Consequently, we cannot generalize our results to larger cities or metropolitan areas. Second, although we provide a plausible explanation for our results using a simplified Median Voter framework, we cannot precisely identify the exact mechanisms at work. To address this limitation, future research could employ qualitative methods or case studies utilizing municipal council minutes to better understand the underlying dynamics. Third, our results are most relevant in institutional contexts where municipalities possess considerable autonomy in land-use planning. In many settings, local councils or parliaments do not hold decision-making power in this area, as more centralized authorities are in charge of the process. As such, our findings may not be directly applicable to situations where land use planning is under the domain of higher-level authorities.

Despite these limitations, to the best of our knowledge, our study represents the first quasi-experimental analysis of the impact of Green Party presence on building policies. As such, we make a valuable contribution to the literature by shedding light on the negotiation of the trade-

offs between housing supply demands and environmental protection in decentralized democratic and industrialized settings. By examining these complex and sometimes conflicting priorities, our research offers a deeper understanding of the decision-making processes that underlie local land use planning, and highlights the role of Green Party members in shaping policy outcomes.

Our paper primarily connects with the limited yet growing literature on the political determinants of land use policies. For example, Solé-Ollé and Viladecans-Marsal (2013) explore the impact of political parties on local land use policies using a regression discontinuity design (RDD) in Spanish municipalities during the 2003-2007 legislative period. Their results reveal that local governments controlled by left-wing parties are more restrictive in converting rural to urban land compared to those governed by right-wing parties. Rather than focusing on the conventional left-right dichotomy, our paper delves into the effects of the presence of environmentalist parties on spatial utilization policies. Another political determinant of building permissions is election cycles. While traditional Political Business Cycle theory primarily revolves around fiscal and monetary policy instruments, recent research has examined non-fiscal or non-monetary variables such as construction permits. Analyzing the influence of opportunistic and partisan politics on building permit issuance, Imami et al. (2018) demonstrates that these factors can significantly impact housing supply. Consistent with the Political Business Cycle theory, the authors posit that municipal incumbents may manipulate construction permits before (general and local) elections to boost economic activity, increase voter satisfaction, or accommodate special-interest groups. Their findings, based on time-series data from post-socialist Tirana, Albania, support the notion that opportunistic and partisan incentives lead to cyclical effects in construction permit licensing. Similarly, research by Martin (2017) indicates that municipal elections in West Germany are also subject to political business cycles.

Furthermore, our paper connects to the literature exploring party effects (Pettersson-Lidbom, 2008). In proportional election systems, small parties play a significant role. The emergence of anti-immigration and environmental parties has led to substantial shifts in Europe's political landscape. However, disentangling the policy effects of small parties can be challenging. Focusing on the influence of green parties on environmental policies, Folke (2014) employs a quasi-experimental Regression Discontinuity Design (RDD) model, demonstrating that small parties have impacted Swedish municipal policies. Specifically, the author finds that the representation of small parties is consequential for immigration and environmental policy, while tax policy remains largely unaffected by the rise of environmental and anti-immigration parties.

Examining the same institutional context as our study, Freier and Odendahl (2015) investigates the connection between political power and tax policies. Using an instrumental variable model that leverages random variation in close elections over two legislative periods in 1996 and 2002, their findings indicate that the center-left party (SPD) tends to reduce municipally

controlled taxes, such as business tax and both types of property taxes, compared to the center-right party (CSU). Interestingly, the study also reveals that the Greens are inclined to increase property taxes. This analysis underscores the distinct policy positions held by various political parties and emphasizes the potential influence of environmentalist parties on local fiscal policies.

Lastly, this study also relates to the broader literature on green governments and the parliamentary representation of environmental protection agendas, highlighting the growing significance of environmentally focused policies in contemporary politics (Neumayer, 2003; Knill et al., 2010; Cheon and Urpelainen, 2013; Garmann, 2014; Schulze, 2021; Jahn, 2022; Töller, 2022; Potrafke and Wuthrich, 2022). We complement the previously highlighted strands of literature by focusing on the role of environmentalist parties in shaping land use policies. In particular, our paper contributes to understanding how the presence of these parties affects spatial utilization and the trade-offs between housing supply and environmental protection at the local level.

The remainder of this paper is organized as follows. Section 2 offers an overview of the institutional context, including the political system, the legal framework for spatial planning, and the parties operating at the Bavarian municipal level, along with their respective platforms. Section 2.4 discusses the potential mechanisms. In Section 4, we first detail the data used in our analysis (Section 3). Next, we outline our empirical model in 4 and present the main results in 5. We then extend the analysis and conduct various robustness checks to validate our findings (5.3). Finally, Section 6 provides a conclusion.

2 Background

2.1 Spatial planning

For the spatial organization of a municipality, the legal framework and instruments play a major role. Although municipalities hold the constitutional right to self-administration (*Kommunale Selbstverwaltung*, article 28, section 2, German constitution) that enables autonomy over land use planning and taxation[1] (Martin, 2017), several other interfering levels exist. Consequently, spatial planning can be seen as a complex connection of institutions and competences. From the state over the federal and regional to the municipal level, details of planning increase and differentiate (Miosga and Norck, 2017).[2]

However, due to the municipal right of self-administration, municipalities play a crucial role in building permissions and long-term spatial planning. They have four primary tools at their

[1] Property tax A and B, business tax.

[2] See A.1 for a detailed description.

disposal: the long-term land use plan (FNP), the more concrete and short-term construction plan (BBP), the municipal accord, and the development freeze. These tools allow municipalities to influence land usage and building structures. Notably, Bavaria is the only state in Germany where the municipal council often has the ultimate decision-making authority in these matters, making it the most suitable setting to explore the relationship between the composition of the council and building permissions.

For our analysis, two important points follow from the institutional settings of spatial planning. First, although planning at the municipal level is the most concrete level of urban and rural design with a certain degree of autonomy, requirements of several other entities interfere with the decisions at the local level. For example, certain municipalities may have different levels of bureaucracy, which could affect the speed and ease of obtaining building permits. To address this potential confounder, fixed effects are included in empirical model to control for the unobserved differences between municipalities that remain constant over time. Additionally, we include time fixed effects in our model to control for time-varying factors that affect the outcome variable, such as changes in state laws or macroeconomic conditions. This helps us to isolate the effect of Green Party presence on the outcome variable (building permissions), without being confounded by changes in state laws or other time-varying factors.

Second, although "illegal", in practice manipulation of spatial plans and decisions can occur for political reasons. In this sense, more likely to be adjusted are the (short-term effective) micro tools: municipal accord and development freeze. The usage of the first might be to costly because of the potential legal consequences. Therefore, the development freeze might be considered a favorable tool for political efforts. An example might be that a building is not allowed to have as many flats as intended in the first place (Martin, 2017). Another example might be that a newly entered party with an environmental focus defines environmental criteria for planning and building structures stricter than the established parties, leading to more development freezes (fewer permitted buildings) as usual. An imaginable example is also that more buildings than usual are permitted around election years due to a change of the BBP, for instance. It could also be that more buildings are permitted because building permission decisions are included more often on the agenda of council meetings during election times.

2.2 Parties

In the state parliament of Bavaria, the CSU has been the largest party since 1946, and has held the office of the Bavarian Minister President except for the years 1954-1957 (Schötz, 2016). At the municipal level, the CSU remains dominant, but there is more variety compared to the state and county levels due to the absence of a five percent hurdle. Approximately 40 parties have been listed for municipal council elections in the years under investigation, with the CSU,

SPD, FDP, and Greens being the most prominent. The Free Voters and the OEDP also have significant influence at the local Bavarian level. However, the right-wing party Alternative für Deutschland (AfD) and left-wing party die Linke are almost irrelevant at the municipal tier, with only 7 and 22 seats in total in 2014, respectively.[3]

Local lists, local list combinations (*Gemeinsame Wahlvorschlaege* and *Waehlergruppen*), local parties (e.g., *Bayernpartei*), as well as independent mayors are also considered important at the Bavarian municipal level. For simplification purposes, the empirical analysis in this research paper subsumes these lists and parties under the category of "other parties and lists" along with remaining small parties.[4]

2.3 Party platforms

Land usage was a key topic in the 2018 Bavarian state election, and two distinct perspectives emerged. The Greens and the OEDP made it a focal point of their agenda, proposing various short-term solutions. In contrast, the CSU, SPD, and Free Voters (FW) viewed land usage as a long-term issue. The parties' proposals are detailed below. Additionally, the controversy surrounding the planned third airstrip at Munich airport serves as a small case study for comparing party positions on large-scale projects.

In 2016, the daily increase of urban area (*Siedlungs- und Verkehrsfläche*) in Bavaria amounted to approximately 10 hectares (Bayerisches Landesamt für Umwelt, 2018). Both the Greens and the OEDP aim to reduce land usage to 5 hectares per day in the short-term. The Greens propose achieving this goal through legislative measures, including certificates, new planning criteria, control systems, and the promotion of inner development, as well as the reorganization of planning at the state level. Similarly, the OEDP advocates for reducing land usage to 5 hectares per day in the short term, as well as freezing land usage in the medium-term, as part of a more radical environmentalist agenda (Centrum für angewandte Politikforschung (LMU), Landesbund für Vogelschutz in Bayern e.V., 2018).

The CSU, SPD, and FDP share the objective of prioritizing densification over using previously unused land. The CSU aims to incentivize the unsealing of land by providing financial support. However, the party opposes the imposition of strict sealing quotas and instead suggests the revitalization of town centers instead of sealing land on the outskirts. Similar to the CSU, the SPD prefers inner development over external expansion. In the long run, the SPD proposes to minimize the increase in land usage by utilizing instruments that balance environmental protection with economic and social needs. The FW calls for more green spaces in city

[3]The AfD entered the Bavarian state parliament for the first time in 2018. The Left Party (*Die Linke*) is traditionally weak in Bavaria, often considered the most conservative German state.

[4]That is, other parties besides the CSU, SPD, Greens, and OEDP.

areas, rather than rigorous densification, and postulates the parsimonious use of building land and industrial areas. The Left Party (Die Linke) advocates unsealing unused land and building high rather than low to reduce land usage and the conversion of rural to urban land. To achieve this goal, the Left proposes a tax on land sealing (Centrum für angewandte Politikforschung (LMU), Landesbund für Vogelschutz in Bayern e.V., 2018).

From the year 2005 onward, there has been an ongoing political debate about the proposed construction of a third airstrip at the Munich airport. Proponents of the project argue in favor of it mainly for economic and capacity reasons. Among the supporters are the public enterprise Flughafen München GmbH, as well as other companies, organizations, and political parties such as the CSU, FDP, and SPD, with the SPD's stance on the issue being more ambiguous and reported inconsistently in the literature. On the other hand, an alliance consisting of different interest groups called "AufgeMUCkt," including churches, environmental groups, and local residents, is attempting to prevent the expansion of the Munich airport due to environmental concerns (Gobert, 2016). The positions of the FW, Greens, OEDP, and Left Party are largely aligned with the opponents of the airport expansion (Centrum für angewandte Politikforschung (LMU), Landesbund für Vogelschutz in Bayern e.V., 2018).

The presented party platform positions have two implications for the empirical analysis. First, it is assumed that the positions of political parties regarding to land conversion, as expressed in the preceding state election, exhibit similarity at the municipal level throughout the periods under investigation (1987-2019). Second, a political division exists between the Greens and OEDP on one side and the other parties on the other side concerning land use. The environmentalist parties advocate for restrictive short-term measures to reduce land conversion to a rate of 5 hectares per day or less, while the other parties call for less restrictive or long-term measures. This division is used to assign treatment and control groups in our difference-in-differences model. According to party agendas, more restrictive land use policies, such as fewer building permits or a smaller conversion from rural to urban land, may be observed in councils involving one or both of these two parties.

2.4 Mechanisms

Our results pose the question of the potential mechanisms at play. Why are building permissions reduced after the entrance of Green Party members into councils even if they are mostly not in majority positions? It is possible that other parties may adopt parts of the Green Party's agenda in an attempt to regain votes from environmentally conscious constituents. This phenomenon, known as policy convergence or policy diffusion (Alesina, 1988; Bennett, 1991; Abel, 2021), occurs when parties adjust their positions on certain issues to appeal to a broader range of voters or to respond to shifting public opinion. As environmental concerns become

increasingly important to voters, dominant parties, for the case of Bavaria the conservative party (CSU), may recognize the need to address these issues more prominently in their platforms. By incorporating elements of the Green Party's agenda, such as promoting sustainable development, reducing CO_2 emissions, or preserving green spaces, these parties can signal their commitment to environmental protection and appeal to voters who prioritize these issues. This strategic adoption of Green Party policies can lead to a greater overall emphasis on environmental considerations in local decision-making processes, even in municipalities where Green Party members are not in majority positions. Consequently, this could contribute to the observed reduction in building permits and short-term housing supply, as more stringent environmental regulations and sustainable urban planning principles are embraced across the political spectrum.

This explanation is in line with the general framework of the Median Voter Model. It posits that political parties will adjust their policy positions to appeal to the median voter, who represents the pivotal point in the distribution of voter preferences. In the context of Green Party influence, the model can help explain the results.

As environmental concerns gain importance among voters, the median voter's preferences shift towards policies that prioritize environmental protection and sustainable development. To appeal to the median voter and regain votes, other parties may adopt elements of the Green Party's agenda, such as stricter building regulations or increased focus on sustainable urban planning. This policy convergence results in a greater overall emphasis on environmental considerations in local decision-making, even in municipalities where Green Party members are not in majority positions. As a result, a decrease in building permits and short-term housing supply may be observed due to the adoption of more environmentally conscious policies across the political spectrum.

Public Choice theory has its roots in the democracy theories proposed by Schumpeter (1942) and Downs (1957), where the latter was strongly influenced by the perspective of the former on modern democratic systems. Schumpeter describes the 'Classical Doctrine of Democracy' as the assumption that politicians base their decisions and actions on a common or public good, regardless of how it is defined. However, as an alternative, he suggests studying the individual motives of politicians in the competition for political leadership to understand policy decisions and outcomes (Schumpeter, 1942).

At the core of Public Choice theory lies the ontological notion that politics should be analyzed in a manner similar to markets. In this framework, political parties and politicians represent the supply side, while voters represent the demand side. Both are assumed to act rationally and in self-interested ways. Candidates (analogous to firms) compete for votes in the political market. They develop party platforms (analogous to products and services) with the aim of maximizing votes and vying for positions (analogous to profit). The voter, faced with

the choice between voting for a party or abstaining, will opt for abstention if the costs of going to the polls are expected to outweigh the benefits (Sunken and Schubert, 2018). he following theoretical framework is built upon these core assumptions.

The basic approach of the median voter theorem (MVT) can be traced back to the contributions of Hotelling (1929), Smithies (1941), and Black (1948). However, it gained prominence through the model introduced by Downs (1957) (Rowley, 1984). Building upon a simple median voter model and the outlined assumptions, theoretical implications pertaining to the main research question are developed in the following.

Consider a scenario where two parties, Red (R) and Blue (B), compete for a municipal council election. The preferences of the voting population are assumed to follow a normal distribution (see Figure A9). In addition to the typical left- and right-wing positions, voters also have preferences regarding environmental topics, such as the issue of land sealing. These preferences may vary from extremist positions to an indifferent position, where individuals do not care at all about this political category.

The parties do not necessarily need to target extreme positions, as those votes may already be secure or unattainable. To secure an absolute majority, a party must obtain at least 50% of the votes plus one additional vote. Therefore, it is crucial to persuade the median voter (M) who holds a preference for new buildings in the municipality while also having concerns about preserving certain areas for environmental reasons. Voters positioned to the right of the blue line are more likely to support party B, while voters who prioritize environmental considerations are better represented by party R (to the left of the red line). Additionally, most voters are located around the median voter. As a result, the battle for the center determines the outcome, which theoretically leads to the adoption of centrist positions.

Due to incomplete information, there is a possibility that parties underestimate the preferences of voters regarding environmental protection in certain municipalities. This could result in the left tail of the density function being larger than anticipated. Consequently, new players, such as a left-wing or conservative Green Party, or even both, may emerge to appeal to these voters and capture their support.

Ignoring coalitions, multidimensional political categories, and other complexities that contribute to the analysis[5], this straightforward adaptation of the model raises a significant question: does the presence of a new party alter the outcome of municipal politics? It is unlikely that an effect attributable to majority decisions would arise, as newly entered parties rarely possess sufficient political power to be in control. Other mechanisms are more likely to come into play. One possibility is that the established parties adjust their positions in response to the new party.

[5]Roemer (2006), for instance, presents modern variations of models that analyze theoretical outcomes of political competition, including models with parties instead of candidates, unfixed preferences, strategic games, or approaches with multidimensional political categories.

Following the logic of the median voter theorem, parties may change their positions towards the entrant to regain lost votes or mitigate potential future vote losses. This adjustment could potentially lead to changes in the rate of land conversion or permitted buildings.

In the context of Bavaria, such adjustments are not unlikely to occur. In recent years, the predominant party, the CSU, has announced a greater focus on "Green" politics. Former Minister President Horst Seehofer, for example, addressed issues related to excessive land use during his tenure (2008-2018). According to his successor, Markus Söder, Bavarian environmental politics are guided by the combination of ecology and economy, as well as the preservation of creation (Hopp and Sebaldt, 2010).

Another possible mechanism could be the utilization of institutional instruments by new parties to revoke land conversion. These instruments are further explained in Section A.1.

3 Data

To investigate whether the election of Green Party members into municipal councils has an effect on the number of building permissions issued, we rely on a combination of three data sources. Table 1 provides an overview of the data used in our analysis.

Table 1: DATA OVERVIEW

Categories	Years and interval	Main variables	Source
Buildings	1983-2021 (1)	Total dwellings and non-residential buildings	GENESIS-Online
Debt	1978-2021 (1)	Total	GENESIS-Online
Elections	1976-2020 (6)	Votes and seats of parties	GENESIS-Online
Employment	2008-2021 (1)	At place of residence	GENESIS-Online
House prices	2008-2022 (1)	House prices index	Klick and Schaffner (2021)
Land use - ALB	1980-2012 (4)	Urban and unsealed area	GENESIS-Online
Land use - ALKIS	2011-2017 (1)	Urban, unsealed, living, and industrial area	GENESIS-Online
Land use - Daytime satellite data	1984-2021 (1)	Built-up, grass, crops, forest, no vegetation, and water area shares	Lehnert et al. (2023)
Mayors	1978-2020 (6)	Votes	Bayerisches Landesamt für Statistik
Population	1987-2021 (1)	Total	GENESIS-Online
Properties	1978-2021 (1)	Average building land prices	GENESIS-Online
Taxes	1980-2022 (1)	Property tax A and B, business tax	GENESIS-Online
Unemployment	2008-2021 (1)	Total	GENESIS-Online

Our first data source is the state statistical office of Bavaria (Bayerisches Landesamt für Statistik, 2023), which contains our primary variables of interest - building permissions - as well as a wealth of economic and demographic data at the municipal level that we use in our empirical investigation.

The buildings data consists of two major categories, namely residential and non-residential buildings. This data has been available at a yearly interval since 1983. However, land use data is only available every four years until 2014. In 2011, the ALB (*Automatisiertes Liegenschaftsbuch*) system was replaced by a new system, ALKIS (*Amtliches Liegenschaftskatasterinformationssystem*), with a transition period from 2011 to 2015 (Bayerisches Staatsministerium für Umwelt und Verbraucherschutz, 2018). Since then, yearly data has been available. Due to the

larger intervals and the change in the documentation system, the land use data from the state statistical office of Bavaria is only used for descriptive statistics.

To address the inconsistencies in the land use data provided by the state statistical office, we utilize yearly interval daytime satellite data, which has been available since 1984. Specifically, we adopt the land coverage data provided by Lehnert et al. (2023) as a proxy for rural to urban land conversion. This data is derived by applying machine learning techniques to Landsat imagery. The authors state that Landsat daytime satellite data offer several advantages over other data sources for characterizing regional economic development. Firstly, Landsat data provide higher spatial resolution (30-m) than other regional administrative or satellite data sources (e.g., night light intensity with a resolution of 1km). This allows for more precise information at a more disaggregated level, enabling characterization of economic development even in smaller localities such as municipalities or urban districts. Secondly, Landsat is the earliest existing source of highly disaggregated satellite data, with the first satellite launched in 1972. This longer time horizon allows researchers to construct longer historical data than other regional economic administrative data or other proxies based on satellite data. Furthermore, the long time series of Landsat data can capture significant changes in regional or even local economic development, which may not be observable in other data sources. Thirdly, Landsat satellites collect multispectral imagery, which captures the energy that the earth reflects in different spectral bands. This information can be used to identify different types of land cover using machine-learning techniques. The authors extend the existing literature by creating a procedure that combines all Landsat data available from 1984 to map six different types of land cover, including built-up surfaces, grassy surfaces, forest-covered surfaces, surfaces with crop fields, surfaces without vegetation, and water surfaces (Lehnert et al., 2023). We use these estimates to compile land cover variables at the municipality level.

Another shortcoming of the data issued by the state statistical office is the absence of house price data. While data on property prices is available and property and house prices are generally positively correlated, the provided data on property prices include a significant share of missing values. Therefore, we retrieve house price data from (Klick and Schaffner, 2021). The RWI-GEO-REDX dataset provides information on the development of housing prices in Germany at the district, municipality, and labor market area level. The dataset is based on a hedonic price regression setup that controls for the quality of the property, allowing for the capture of various features of the sales and rent prices beyond the observation of average prices. We utilize the regional price indices relative to the German mean, which are available on a yearly basis since 2008. Specifically, we extract the index for house purchase and its yearly difference and combine this data with the previously described data of municipal characteristics.

The following sections present descriptive statistics for the central variables of interest. A detailed summary of all variables highlighted in section 3 can be found in Table A1 in the

Appendix. First, we provide figures related to rural to urban land conversion and land sealing. Second, we illustrate the development of political representation at the municipal level. Thirdly, we display the development of permissions for both major building categories - residential and non-residential. Lastly, we show summary statistics and conduct a balance test of treated and untreated municipalities.

3.1 Land usage

Figure 1 depicts the urban (and traffic) area[6] per inhabitant as of 2019, which is highly correlated with the sealed area. From the late 1980s until 2012, the average urban area per resident increased by around 100 sqm (550 to 650 sqm). A substantial proportion of the conversion from rural to urban land might be explained by the transformation from an agrarian to an industrial state that took place in Bavaria. Accounting for 12 percent of the total area, the urban area share of Bavaria is lower than the German average. However, with around 10 ha daily conversion from unsealed to urban areas, Bavaria ranks at the top of all German states (2016). In many cases, agrarian land is converted to urban land. Many rural municipalities of Bavaria range between 500 and 650 sqm of sealed area per inhabitant. Nearly ten percent of the municipalities belong to the highest-level category ($>$ 900 sqm). In general, the northern and rather rural areas have the highest ratios. Particularly low values can be found in the metropolitan areas of *Muenchen*, *Nuernberg*, and *Augsburg*, which suggests that urban area in these regions is allocated more efficiently (Bayerisches Landesamt für Umwelt, 2018).

3.2 Green Party representation

Figure A2 in the Appendix displays the percentage shares of seats in the last seven legislature periods at the local level, covering a total of 2,056 municipalities. The number of seats varies depending on the population size, which was 30,530 in 1978 and 32,810 in 2014. The figure suggests a strong conservative block, which holds approximately 80% of the seats. The remaining seats are held by a smaller center-left (SPD) and environmental party block. While the presence of the Greens and OEDP in municipal councils in the 1980s was negligible, a substantial gain of seats can be observed from 1990 to the present day. Specifically, in 1984,

[6]Urban and traffic area is defined as the sum of the following areas: "living" (*Wohnen*), "commercial or industrial" (*Gewerbe or Industrie*), "other buildings and open space" (*sonstige Gebäude- und Freifläche*), "operating" (*Betriebsfläche ohne Abbauland*), "green" (*Grünanlage*), "other recreational" (*sonstige Erholungsfläche*), "traffic" (*Straße, Weg, Platz*), "other traffic" (*sonstige Verkehrsfläche*), and "cemetery" (*Friedhof*). The remaining (unsealed) area categories out of the total 17 categories of the ALB system are: "moor" (*Moor*), "heath" (*Heide*), "agricultural" (*Landwirtschaftsfläche ohne Moor und Heide*), "forest" (*Waldfläche*), "water" (*Wasserfläche*), "wasteland" (*Unland*), "mining" (*Abbauland*), and "other" (*Flächen anderer Nutzung ohne Unland, Friedhof*).

the Greens and OEDP held only 121 and 3 seats, respectively, which corresponds to a share of 0.4%. In contrast, in 2014, they held 941 and 113 seats, which corresponds to a share of 3.2%. As pointed out before, this increase of presence of environmental parties is exploited for the treatment and control group assignment in the difference-in-differences model. In particular, we define treated municipalities as regional units where at least one seat in the local parliament is held by the Green Party. Conversely, we refer to untreated municipalities as regional units without any Green Party presence in their local parliament.

Figure 2 suggests that the Greens have been particularly successful in metropolitan and more urbanized areas. This is not surprising, as small or special interest parties like the Greens tend to be more successful in urban areas due to several factors, including their focus on issues that are more relevant to urban residents, such as environmental protection, social justice, and urban development. In addition, urban areas tend to be more diverse and liberal, making them more receptive to progressive and alternative political movements.

While it may be argued that the election of Green Party members into municipal councils is not a random event, from a macro perspective, we observe that the geographic distribution of treated municipalities does not follow a specific pattern, except for the above described pattern for urban areas. Especially, we note that the geographic reach of Green Party representation is rather unsystematic. This strengthens our argument that the evidence we present may be interpreted as quasi-random. Furthermore, we observe that the Greens are also present in many municipalities with relatively low values of urban and traffic area per resident. This suggests that the election of Green Party members into municipal councils cannot be attributed mainly to efforts to address high rural-to-urban land conversion rates. As such, our descriptive evidence allows us to rule out reverse causality concerns.

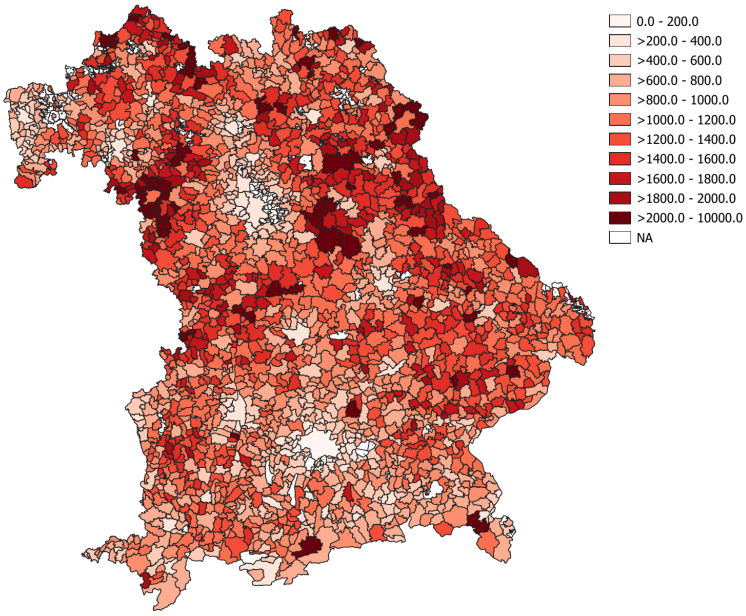

Figure 1: URBAN AND TRAFFIC AREA IN SQUARE METERS PER INHABITANT (2019). This figure displays the urban and traffic areas of Bavarian municipalities for the year 2019, measured in square meters per inhabitant. The data was obtained from the ALKIS database, which provides information on land usage in four categories (Bayerisches Landesamt für Statistik, 2023). To calculate the variable, the urban (*Siedlung*) and traffic (*Verkehr*) areas were summed up per municipality and divided by the total population.

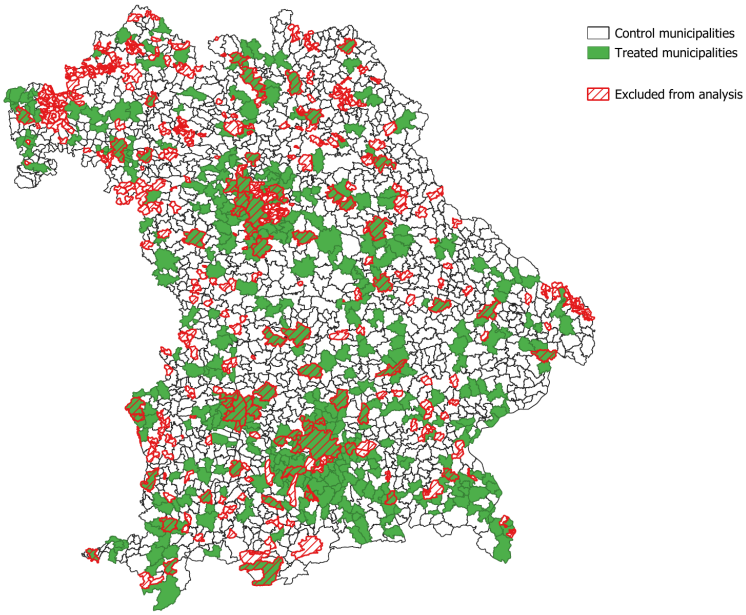

Figure 2: TREATED AND UNTREATED MUNICIPALITIES ACROSS BAVARIA. This figure indicates municipalities where the Green Party at least once gained a seat in the local council during our period of investigation (1987-2019).

3.3 Building permissions

The data in Figure 3 suggests that there is a common trend in the permitted dwellings (per 1,000 inhabitants) across the different administrative districts of Bavaria. Specifically, from the early 1980s up to the beginning of the 21st century, building permits appear to oscillate around certain levels in each entity. Following this, up to the financial crisis in 2008, permits decreased, with a steeper decline observable in the years preceding the crisis. Since then, building permits have been on a growth trajectory. Furthermore, the data indicates that around municipal election years, there are sharper increases or reduced downward trends of permitted dwellings, except for the year 1984. For instance, the increase in permitted buildings from 1989 to 1990 appears to be sharper than in the previous years in most administrative districts. However, in the year following the election year (1991), a decrease in permitted dwellings is observable, with the exception of *Oberfranken*, *Mittelfranken*, and *Niederbayern*. Similar kinks (upward and downward) around election years are noticeable in *Niederbayern*, *Unterfranken*, and *Mittelfranken*.

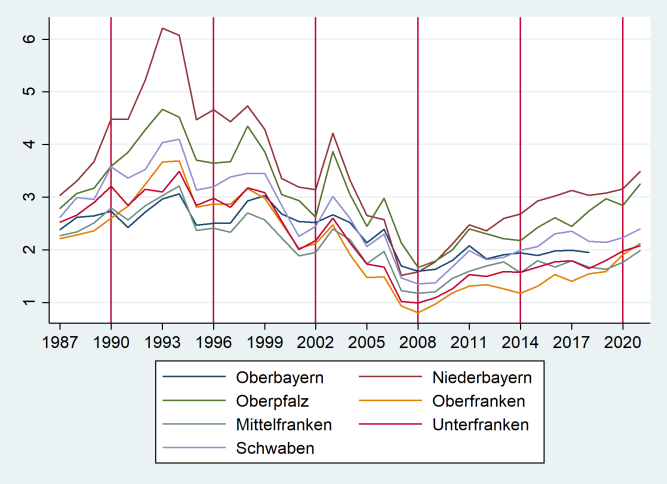

Figure 3: PERMITTED DWELLINGS PER 1,000 INHABITANTS (1987-2021). This figure displays permitted residential buildings per 1,000 inhabitants at the level of the 7 administrative districts of the Bavarian state. The vertical red lines indicate election years.

The descriptive statistics of building permissions suggest opportunistic political behavior around election years. However, this interpretation should be taken with a pinch of salt, as two major historical events coincided with the election years of 1990 and 2008. The first event is the German reunification in 1990, which could have influenced building permits due to the influx of migrants from the former East German states. This could also explain the subsequent steep positive trend in building permits. In fact, Bavaria was the primary destination for East-West migrants from 1990 to 2012, accounting for every fifth to fourth of inner German migration (Dorn and Doering-Manteuffel, 2018). The second event is the financial crisis of 2008, which may have interrupted the downward trend in building permits due to corresponding sharp drops

in interest rates for mortgage loans. As a result, building houses became cheaper due to the easy money policy that followed the crisis, which might explain some of the upward trend in building permits up to 2017.

As Figure A3 in the Appendix implies, the overall trend for non-residential buildings appears to be similar. However, compared to the permits of residential buildings, approvals of non-residential buildings seem to be unaffected by the financial crisis. Interestingly, the above described pattern around election years is hardly observable.

3.4 Summary and balance statistics

To address the potential bias stemming from the higher complexity of urban areas, the regression analysis focuses on municipalities with a population ranging between 1,000 and 20,000 inhabitants. Municipalities with a population smaller than 1,000 were excluded due to a lack of variation in the data. The upper threshold of 20,000 aligns with the official definition of small towns (*Kleinstaedte*) in Germany. Furthermore, as noted earlier, excluding municipalities with more than 20,000 residents is reasonable because land use determinants in urban and metropolitan areas may differ from those in rural areas (Glaeser and Kahn, 2010). Our final estimation sample for the baseline estimations consists of 1,910 municipalities over the period 1987-2019. For reference, summary statistics for the excluded subsamples and the subsample used in the regression analysis are provided in the Appendix (Table A1).

Table A2 (Appendix) displays balance statistics between municipalities where the Greens or the OEDP or both are not part of the municipal council (control group) and vice versa (treatment group).[7] The table implies that these two groups of municipalities are significantly different regarding a set of variables. Treated municipalities tend to be larger in population size. Moreover, municipalities under environmental party council involvement are more urbanized, documented by the six percentage points greater urban area share. This is also indicated by the price for building land that is on average more than twice as large in these towns. While these differences yield informative insights, their practical implications appear to be limited. To address these differences in our analysis, we adopt several strategies.

First, to account for time invariant municipality-specific differences we incorporate municipal fixed effects. Thereby, we control for factors that do not change over time, such as geography. For example, municipalities located in mountainous regions or near bodies of water may have more stringent environmental regulations, leading to fewer building permits.

Second, by including time fixed effects our methodology considers time varying factors that similarly influence all municipalities. Specifically, we account for macroeconomic develop-

[7] In this context, explicit means that the parties line up as own lists. Not seldom different parties are enrolled together in one list. In the our data set, these cases belong to the category "other parties and lists".

ments that affect the entire state. Third, we include a range of covariates that reflect various municipality-level dynamics, such as population growth, budgetary constraints, employment rates, and changes in land use. We provide evidence that our results are robust to the inclusion of a large set of covariates.

Lastly, we show that the parallel trends assumption holds six years prior to elections using various staggered difference-in-differences estimators.

4 Empirical strategy

The main goal of this paper is to identify the impact of green parties (Greens and OEDP) on building permissions. A simple design may suffer from endogeneity concerns, which may obscure a causal interpretation.

On the one hand, the context of our study raises concerns about reverse causality. For example, a municipality that previously experienced high rural to urban land conversion may be more likely to elect Green Party members into the council. However, we have ruled out such concerns in Section 3.1. Moreover, a naive estimation approach would suffer from omitted variable bias. To mitigate this issue, we utilize the (balanced) panel structure of the sample and include a large set of covariates, as described in the previous section 3.4. On the other hand, a main identifying assumption is that the expansion of the Green Party presence is exogenous. Except for close elections below and above the threshold for the first seat, it can be doubted that the election of members of environmentalist parties into councils is a random event. We report event-studies that allow us to relax this assumption.

We exploit the staggered expansion of Green Party representation in municipal councils within the following model to estimate the effect on building permissions as follows:

$$y_{it} = \alpha_i + \gamma_t + \beta x_{i,t} + \rho \mathrm{E}_{i,t} + \varepsilon_{i,t}, \tag{1}$$

where y_{it} represent building permissions in municipality i in year t, α_i municipality fixed effects, γ_t year fixed effects, a set of covariates $x_{i,t}$, and $E_{i,t}$ a dummy that is 1 when there is at least one Green Party member in the council of municipality i in year t and 0 else.

Although TWFE regressions similar to equation 1 are commonly used in staggered adoption research designs, they have been shown to produce consistent estimates only under relatively strong assumptions about treatment effect homogeneity (Baker et al., 2022; Borusyak et al., 2022; Callaway and Sant'Anna, 2021; Goodman-Bacon, 2021; de Chaisemartin and D'Haultfœuille, 2020; Sun and Abraham, 2021). Specifically, as demonstrated by Goodman-Bacon (2021) and Gardner (2022), the TWFE estimator calculates a weighted average of all possible 2×2 difference-in-differences comparisons between groups of units treated at differ-

ent points in time. If treatment effects are homogeneous across treated groups and time, the TWFE estimator is consistent for the ATT. However, if treatment effects are heterogeneous across groups or time, the TWFE estimator may not produce consistent estimates for the ATT.

To address doubts about the soundness of the TWFE estimator, we reproduce our results using the two-stage difference-in-differences model introduced by Gardner (2022). This estimator is robust to treatment effect heterogeneity in the presence of staggered treatment adoption. The method employs a two-stage procedure to estimate the average treatment effects. In the first stage of the two-stage DiD estimator, the outcome variable is regressed on municipality- and year-specific effects, along with any relevant explanatory variables. This initial stage only utilizes untreated observations. In the second stage, the outcome measure is adjusted by subtracting the effects of the explanatory variables, as well as the year and group effects identified in the first stage. The adjusted outcome measure is then regressed on the treatment variables of interest. By subtracting out the effects of the period and group effects in the second stage, the residual becomes uncorrelated with these effects. This addresses potential issues related to weighting and differential treatment times that may arise in conventional differences-in-differences estimates. In addition to estimating equation 1, we also report the results of this two-stage process to account for potential bias in our TWFE estimates.

5 Results

5.1 Main results

5.1.1 Residential buildings

Table 2 presents the baseline results using two different approaches: the TWFE model following estimating equation 1 (columns 1 and 2) and the two-stage difference-in-differences (2SDID) model proposed by Gardner (2022) (columns 3 and 4). In column 1, which represents the baseline TWFE estimate without controls, we find no significant effect of Green Party presence on building permissions. However, when we introduce additional controls in model 2, we observe a statistically significant decrease of approximately 3.4% in treated municipalities. To further assess these results, we re-estimate models 1 and 2 using the 2SDID approach. The coefficients of interest appear to be larger in magnitude and exhibit higher statistical significance compared to the baseline TWFE models. These findings suggest that the entrance of Green Party members into municipal councils leads to a significant decrease in building permissions. Overall, the results from the 2SDID models provide stronger evidence for the impact of Green Party presence on building permissions, supporting the hypothesis that the presence of environmentalist parties in councils has a restrictive effect on construction activities.

Table 2: BASELINE RESULTS: RESIDENTIAL BUILDINGS

	Two-way fixed-effects		Gardner (2022)	
	(1)	(2)	(3)	(4)
Green party presence	-0.0041	-0.0343*	-0.0258**	-0.0560***
	(0.0195)	(0.0192)	(0.0130)	(0.0150)
Observations	59,130	57,140	59,130	57,140
Controls		✓		✓
Municipality FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓

This table collects results for specifications following Equation 1 (columns 1 and 2) and the method by (Gardner, 2022) (columns 3 and 4). We study whether the entrance of Green Party members into municipal councils leads to an average decrease in residential building permissions. Therefore, the dependent variable captures the logarithm of residential building permissions. The included covariates (columns 2 and 4) are population counts, total debt, property and business tax assessment rates, and the logarithm of the built-up area. The two-way fixed-effects estimation includes a constant that is not reported in the table. Stars indicate significance levels at 10%(*), 5%(**) and 1%(***). Heteroscedasticity- and cluster-robust standard errors in parentheses. Municipalities are the units of clustering.

To examine the validity of the parallel trends assumption and analyze the dynamics of treatment effects, we generate event-study versions of the two-way fixed effects (TWFE) model and the estimator proposed by Gardner (2022). Furthermore, we present four alternative staggered estimators to capture different treatment dynamics (see Figure 4).

Among these six estimators (Gardner, 2022; Callaway and Sant'Anna, 2021; Sun and Abraham, 2021; Borusyak et al., 2022; de Chaisemartin and D'Haultfœuille, 2020), the estimator developed by de Chaisemartin and D'Haultfœuille (2020) allows for treatment status switches, while the other estimators assume that once a unit (municipality) is treated, it remains treated throughout the analysis period. In addition to parallel trends, a key assumption shared by all the estimators is limited anticipation. In the specific setting of our study, it is unlikely that anticipatory effects are present, as individuals have very limited information about future entrances of Green Party members (and its potential impact on building permissions). Additionally, Gardner (2022) and Borusyak et al. (2022) assume the correct specification of $Y(0)$ due to the imputation method. These two estimators fall within the category of imputation-based estimators and rely on residualizing the outcome variable and then averaging those estimates to compute the event-study average treatment effect. The estimators by Callaway and Sant'Anna 2021; Sun and Abraham 2021 fall within the category of staggered difference-in-differences estimators that exploit two-by-two aggregations. These estimation procedures involve estimating τ_{gt} for all group-time pairs. To estimate a specific τ_{gt}, these packages utilize a two-period (periods t and $g-1$) and two-group (group g and a designated control group) difference-in-differences estimator, commonly known as a 2x2 difference-in-differences. The choice of the control group varies depending on the specific estimator used.[8] Subsequently, the estimator aggregates τ_{gt} across all groups that received treatment for at least k periods, to estimate the event-study aver-

[8]For all six estimators we specify not-yet and never treated units as comparison group.

age treatment effect τ_k. The 2x2 aggregation designs do not compute a parametric form of $Y(0)$. Therefore, this set of estimators mainly relies on the parallel trends assumption. Imputation-based estimators primarily rely on the parallel trends assumption as well, however, they also require the additional assumption that the parametric model of $Y(0) = \mu_i + \eta_t + \varepsilon_{it}$ is correctly specified (Gardner, 2022).

Figure 4 presents the event study coefficients obtained from the different estimation approaches. The estimated coefficients of the different models reveal a similar pattern and are consistent with the parallel trends assumption, as we find no evidence of systematic pre-trends. The results indicate a substantial decrease in building permissions starting after the treatment timing in $t = 0$ up to $t = 5$. Figure A5 in the Appendix reports the results including covariates. Both event studies deliver convincing results regarding the causality of our baseline estimates for permissions of residential buildings.

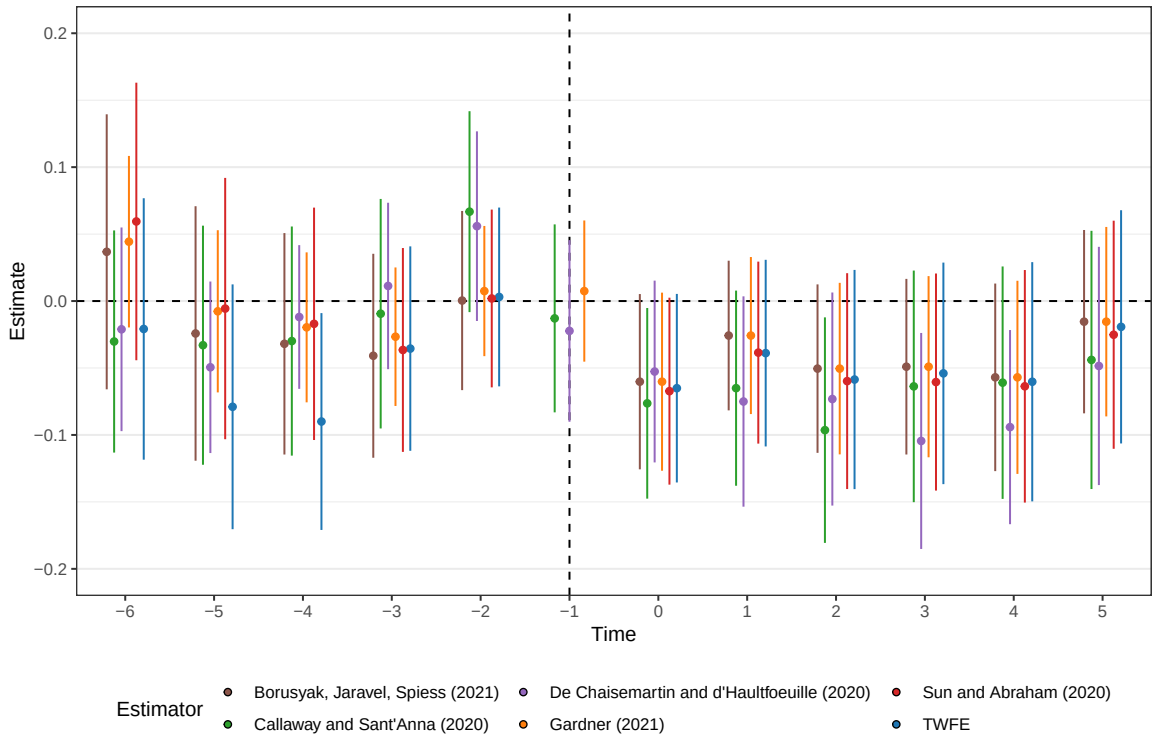

Figure 4: EVENT-STUDY ON GREEN PARTY PRESENCE AND RESIDENTIAL BUILDING PERMISSIONS. This figure displays the event-study plots generated using six different estimators to examine the impact of treatment on the logarithm of residential building permissions. The utilized estimators include the dynamic version of the TWFE model (blue), Gardner (2022) (red), Sun and Abraham (2021) (red), Callaway and Sant'Anna (2021) (green), De Chaisemartin and d'Haultfoeuille (2020) (purple), and Borusyak, Jaravel, and Spiess (2021) (brown). To compute these estimates, we used the *did2s* and textitdid_multiplegt R packages. The comparison groups are defined by the default settings: not-yet and never treated entities (municipalities). The x-axis represents the time variable, which is measured in years, and the vertical reference line indicates the last pre-treatment year. The y-axis represents the estimates for the logarithm of building permissions. The bars on the plot represent 95 percent confidence intervals, with standard errors clustered at the municipal level.

5.2 Non-residential buildings

In this section, we examine whether our findings regarding the impact of green parties on building permits for residential buildings extend to non-residential buildings. A prevailing narrative suggests that green parties are particularly critical of the development of residential areas, predominantly composed of single-family houses as the main building structure.[9] This perception is grounded in the circumstance that single-family houses, which constitute the primary type of residential buildings in rural Bavaria, typically require larger land areas compared to multi-unit buildings, such as apartments or townhouses, to accommodate an equivalent number of households. This circumstance can contribute to urban sprawl, increased energy and resource consumption, and elevated infrastructure costs. Given their emphasis on sustainable development and environmental protection, environmentalist parties may advocate for stricter regulations and guidelines for residential construction projects as opposed to other building categories. If this hypothesis holds, the results presented below should markedly diverge from our findings for residential buildings.

Therefore, we replicate the estimations conducted in the previous section, but this time using non-residential buildings as the dependent variable. The results are presented in Table 3. In line with our findings for residential buildings, we observe a similar pattern. Except for the TWFE specification without controls, all estimators reveal statistically and economically significant coefficients. The estimates are more pronounced when employing the estimation approach outlined by (Gardner, 2022).

Table 3: BASELINE RESULTS: NON-RESIDENTIAL BUILDINGS

	Two-way fixed-effects		Gardner (2022)	
	(1)	(2)	(3)	(4)
Green party presence	-0.0256	-0.0571***	-0.0261*	-0.0659***
	(0.0208)	(0.0212)	(0.0140)	(0.0171)
Observations	53,016	51,228	52,970	51,184
Controls		✓		✓
Municipality FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓

This table collects results for specifications following Equation 1 (columns 1 and 2) and the method by (Gardner, 2022) (columns 3 and 4). We study whether the entrance of Green Party members into municipal councils leads to an average decrease in non-residential building permissions. Therefore, the dependent variable captures the logarithm of non-residential building permissions. The included covariates (columns 2 and 4) are population counts, total debt, property and business tax assessment rates, and the logarithm of the built-up area. The two-way fixed-effects estimation includes a constant that is not reported in the table. Stars indicate significance levels at 10%(*), 5%(**) and 1%(***). Heteroscedasticity- and cluster-robust standard errors in parentheses. Municipalities are the units of clustering.

Subsequently, we conduct event-study analyses to understand how the treatment effect on non-residential buildings evolves over time. The results are visualized in Figure 5. Remarkably,

[9] See, for example: https://www.deutschlandfunk.de/debatte-ueber-einfamilienhaeuser-die-gruenen-und-der-100.html

the pattern of estimates from both imputation-based methods (Gardner, 2022; Borusyak et al., 2022) for non-residential buildings closely mirrors that of residential buildings, demonstrating a short-term reduction in building permissions for non-residential buildings following the treatment's introduction. However, we only observe an absence of systematic pre-trends in the 2SDID estimates. The remaining estimators present a divergent image, as we cannot pinpoint a convincing reduction in building permissions and observe more heterogeneous pre-trends. Yet, when covariates are included, the pattern closely aligns with that observed for residential buildings (see Appendix, Figure A5). Conditional on covariates, the parallel trends assumption holds for all models except for TWFE. These results suggest that, in addition to residential buildings, the presence of environmentalist parties also negatively affects non-residential building permissions.

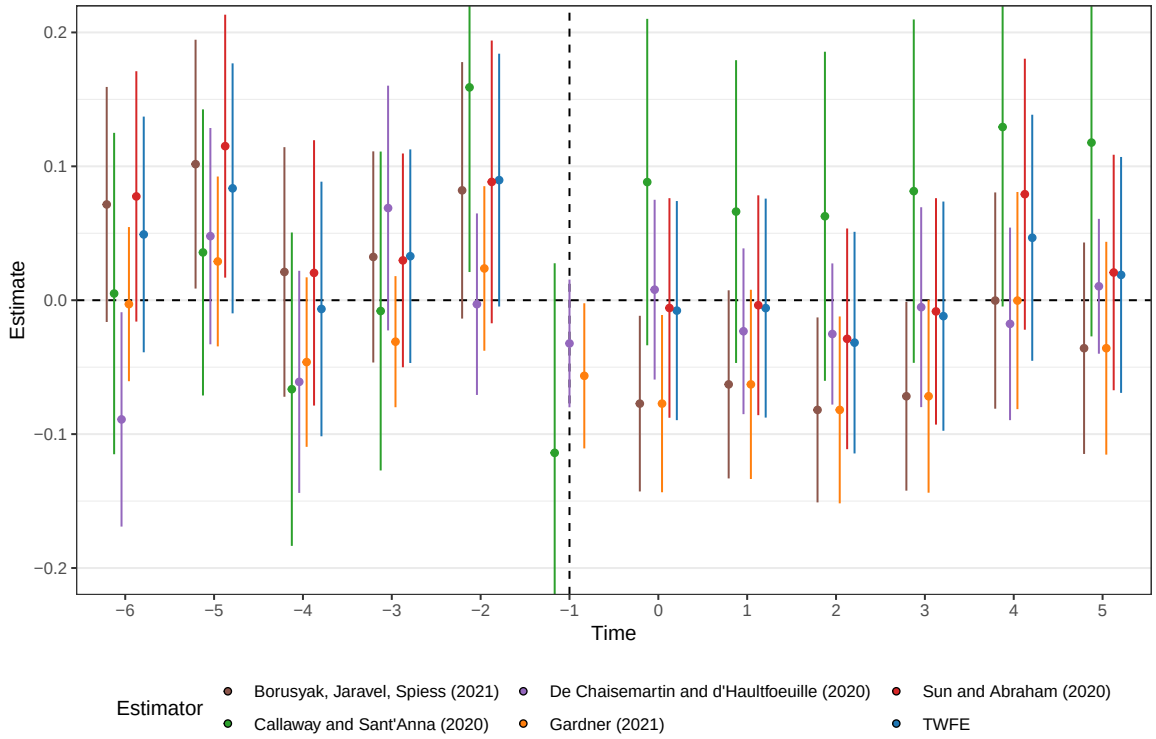

Figure 5: EVENT-STUDY ON GREEN PARTY PRESENCE AND NON-RESIDENTIAL BUILDING PERMISSIONS. This figure displays the event-study plots generated using six different estimators to examine the impact of treatment on the logarithm of non-residential building permissions. The utilized estimators include the dynamic version of the TWFE model (blue), Gardner (2022) (red), Sun and Abraham (2021) (red), Callaway and Sant'Anna (2021) (green), De Chaisemartin and d'Haultfoeuille (2020) (purple), and Borusyak, Jaravel, and Spiess (2021) (brown). To compute these estimates, we used the *did2s* and *did_multiplegt* R packages. The comparison groups are defined by the default settings: not-yet and never treated entities (municipalities). The x-axis represents the time variable, which is measured in years, and the vertical reference line indicates the last pre-treatment year. The y-axis represents the estimates for the logarithm of building permissions. The bars on the plot represent 95 percent confidence intervals, with standard errors clustered at the municipal level.

5.3 Extensions and robustness tests

In the following, we document additional findings and report statistics concerning the strength and validity of the baseline treatment effects. These results will guide us toward the subsequent discussion on mechanisms in Section 2.4.

5.3.1 Mayors

While mayors with an affiliation to environmentalist parties are still uncommon in Bavarian municipal councils (only 24 were in power during our period of investigation), their position grants them the authority to influence building permissions as they are responsible for signing the documents that grant these permissions (see Section A.1 for details). However, it remains uncertain whether this positional power manifests in observable empirical results. To explore this question, we employ the appointment of mayors as a criterion for assigning a new treatment group, where municipalities without a green mayor serve as the control group. The estimated results of this specification are provided in Table 4 (with permitted residential buildings as the outcome variable) and Table 5 (with permitted non-residential buildings as the outcome variable).

Table 4: MAYORS AS TREATMENT, RESIDENTIAL BUILDINGS

	Two-way fixed-effects		Gardner (2022)	
	(1)	(2)	(3)	(4)
Mayor	-0.1717***	-0.1766***	-0.0477***	-0.0504***
	(0.0538)	(0.0561)	(0.0134)	(0.0144)
Observations	59,130	57,140	59,130	57,140
Controls		✓		✓
Municipality FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓

This table collects results for specifications following Equation 1 (columns 1 and 2) and the method by (Gardner, 2022) (columns 3 and 4). We study whether the entrance of Green mayors into municipal councils leads to an average decrease in residential building permissions. Therefore, the dependent variable captures the logarithm of residential building permissions at the municipality level. The included covariates (columns 2 and 4) are population counts, total debt, property and business tax assessment rates, and the logarithm of the built-up area. The two-way fixed-effects estimation includes a constant that is not reported in the table. Stars indicate significance levels at 10%(*), 5%(**) and %(***). Heteroscedasticity- and cluster-robust standard errors in parentheses. Municipalities are the units of clustering.

Interestingly, our analysis shows that Green mayors appear to influence the authorization of residential buildings, while not significantly affecting non-residential buildings. It's worth noting that our specifications including covariates (columns 2 and 4) account for the presence of environmentally-focused parties in councils by utilizing a dummy control variable. However, given the considerable differences between the estimates of the TWFE models and those of the Gardner (2022) models for residential buildings (Table 4), we conjecture that the former might not accurately capture treatment effect heterogeneity. Moreover, the estimates of the Gardner

Table 5: MAYORS AS TREATMENT, NON-RESIDENTIAL BUILDINGS

	Two-way fixed-effects		Gardner (2022)	
	(1)	(2)	(3)	(4)
Mayor	-0.1119	-0.1116	-0.0204	-0.0252
	(0.0933)	(0.0906)	(0.0351)	(0.0371)
Observations	53,016	51,228	53,016	51,228
Controls		✓		✓
Municipality FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓

This table collects results for specifications following Equation 1 (columns 1 and 2) and the method by (Gardner, 2022) (columns 3 and 4). We study whether the entrance of Green mayors into municipal councils leads to an average decrease in non-residential building permissions. Therefore, the dependent variable captures the logarithm of non-residential building permissions at the municipality level. The included covariates (columns 2 and 4) are population counts, total debt, property and business tax assessment rates, and the logarithm of the built-up area. The two-way fixed-effects estimation includes a constant that is not reported in the table. Stars indicate significance levels at 10%(*), 5%(**) and %(***). Heteroscedasticity- and cluster-robust standard errors in parentheses. Municipalities are the units of clustering.

(2022) model align with our previous findings, showing strong evidence for a reduction in residential buildings but rather mixed results for non-residential buildings under environmentalist party presence. As a result, we infer that Green mayors exhibit greater restrictiveness in granting permissions for residential buildings compared to their non-environmentalist counterparts. Consistent with the aforementioned hypothesis of a specific negative bias of environmentalist parties towards this category, we observe a statistically significant decrease of approximately 5% in permitted residential constructions after the adoption of the treatment. These findings lend credibility to the narrative that the focus on residential buildings may not be purely speculative but rather based on empirical observations. Nonetheless, the (external) validity of the results is limited by the fact that our sample includes only 24 municipalities that have ever had a Green mayor in office.

5.3.2 Permitted living space

We expand our analysis to incorporate an alternative outcome variable, specifically to ascertain if our initial findings align with a decrease in available living space. One could argue that a decrease in permits for residential buildings does not inherently indicate a reduction in living space or apartments. This idea is based on a potential scenario where approvals are granted for taller buildings as a substitute for the construction of multiple smaller structures, which might have a higher average environmental impact per resident. To assess this proposition, we use permitted living space as the outcome variable. Our analysis reveals a negative association between these variables and the presence of environmentalist parties (Table 6, columns 3 and 4). Thus, assuming that the TWFE models may yield biased estimates, we infer that the previously detected reduction in permitted dwellings is indeed accompanied by a decrease in living space.

Table 6: ALTERNATIVE OUTCOME: LIVING SPACE PER 1,000 INHABITANTS

	Two-way fixed-effects		Gardner (2022)	
	(1)	(2)	(3)	(4)
Green party presence	-0.0190	-0.0192	-0.0271**	-0.0241*
	(0.0202)	(0.0200)	(0.0132)	(0.0135)
Observations	59,130	57,140	59,130	57,140
Controls		✓		✓
Municipality FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓

This table collects results for specifications following Equation 1 (columns 1 and 2) and the method by (Gardner, 2022) (columns 3 and 4). We study whether the entrance of Green Party members into municipal councils leads to an average decrease in living space per 1,000 inhabitants. Therefore, the dependent variable captures the logarithm of permitted living space in square per 1,000 inhabitants (in residential buildings). The included covariates (columns 2 and 4) are total debt, property and business tax assessment rates, and the logarithm of the built-up area. The two-way fixed-effects estimation includes a constant that is not reported in the table. Stars indicate significance levels at 10%(*), 5%(**) and 1%(***). Heteroscedasticity- and cluster-robust standard errors in parentheses. Municipalities are the units of clustering.

5.3.3 Adjacent municipalities as control group

It may be argued that regional patterns around treated municipalities occur, such as more urbanized populations with a stronger preference for stricter land regulation. These heterogeneities may not be fully captured by our previous estimation approaches.

To create treatment and control groups that are more similar regarding geographic spread, we proceed as follows. We identify all municipalities that share a communal border with municipalities that have ever received treatment. We then exclude all municipalities from our estimation sample that do not fulfill this condition. Using this reduced sample, which only includes adjacent municipalities as the control group, we replicate our baseline specifications. The total number of municipalities included in this sample is 1,250. Figure A6 geographically depicts this sample. Table 7 reports the results for residential buildings, and Table 8 reports the results for non-residential buildings. The results indicate a more pronounced effect for both estimators and both building categories. Overall, these findings demonstrate that our results suggesting a decrease in building permissions under Green Party presence remain robust if we only include neighboring municipalities as the control group.

5.3.4 Placebo difference-in-differences

We conduct placebo regressions to assess the robustness of our baseline estimates. The purpose of these placebo regressions is to determine whether the observed treatment effects are statistically significant or merely a result of random chance. If our baseline results were obtained due to chance alone, randomly assigning treatments to non-treated municipalities should yield similarly significant coefficients. However, if the placebo regressions with randomly as-

Table 7: ADJACENT MUNICIPALITIES AS CONTROL GROUP, RESIDENTIAL BUILDINGS

	Two-way fixed-effects		Gardner (2022)	
	(1)	(2)	(3)	(4)
Green party presence	-0.0223	-0.0423*	-0.0364**	-0.0597***
	(0.0220)	(0.0218)	(0.0153)	(0.0173)
Observations	39,169	37,870	39,169	37,870
Controls		✓		✓
Municipality FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓

This table collects results for specifications following Equation 1 (columns 1 and 2) and the method by (Gardner, 2022) (columns 3 and 4). Utilizing a restricted sample comprising only municipalities that share a communal border with those that have ever received treatment (1,250 in total, see Figure A6), we study whether the entry of Green Party members into municipal councils results in an average decrease in residential building permissions. Therefore, the dependent variable captures the logarithm of residential building permissions. The included covariates (columns 2 and 4) are population counts, total debt, property and business tax assessment rates, and the logarithm of the built-up area. The two-way fixed-effects estimation includes a constant that is not reported in the table. Stars indicate significance levels at 10%(*), 5%(**) and 1%(***). Heteroscedasticity- and cluster-robust standard errors in parentheses. Municipalities are the units of clustering.

Table 8: ADJACENT MUNICIPALITIES AS CONTROL GROUP, NON-RESIDENTIAL BUILDINGS

	Two-way fixed-effects		Gardner (2022)	
	(1)	(2)	(3)	(4)
Green party presence	-0.0414*	-0.0617**	-0.0391**	-0.0703***
	(0.0242)	(0.0244)	(0.0167)	(0.0197)
Observations	35,310	34,137	35,264	34,093
Controls		✓		✓
Municipality FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓

This table collects results for specifications following Equation 1 (columns 1 and 2) and the method by (Gardner, 2022) (columns 3 and 4). Utilizing a restricted sample comprising only municipalities that share a communal border with those that have ever received treatment (1,250 in total, see Figure A6), we study whether the entry of Green Party members into municipal councils results in an average decrease in non-residential building permissions. Therefore, the dependent variable captures the logarithm of non-residential building permissions. The included covariates (columns 2 and 4) are population counts, total debt, property and business tax assessment rates, and the logarithm of the built-up area. The two-way fixed-effects estimation includes a constant that is not reported in the table. Stars indicate significance levels at 10%(*), 5%(**) and 1%(***). Heteroscedasticity- and cluster-robust standard errors in parentheses. Municipalities are the units of clustering.

signed treatments yield coefficient estimates centered around zero, it suggests that the baseline estimates signify substantive negative effects of the presence of environmentalist parties.

To perform placebo regressions, we proceed as follows. We first remove the 409 treated municipalities from the sample, resulting in a reduced sample of 1,509 initially untreated municipalities. To mimic the staggered treatment adoption in our study, we randomly select 50 municipalities per election year (1990, 1996, 2002, 2008, 2014) from this reduced sample and assign them placebo treatments. We then re-estimate the baseline specifications using the methodology proposed by Gardner (2022). We repeat this process 1,000 times for each specification and plot the cumulative distribution of the estimated coefficients in Figures A7 (residential buildings) and A8 (non-residential buildings), where the coefficient estimates are represented by black dots.

Our analysis reveals that the placebo estimates for residential buildings are centered around zero, providing further evidence that our baseline results for this category are robust. Additionally, only a few of the placebo coefficients in both specifications are of similar magnitude to the treatment effects observed for non-residential buildings. This indicates that the reduction in residential buildings can indeed be attributed to the presence of the Green Party.

However, in the case of non-residential buildings, the cumulative distribution function of the placebo difference-in-differences regressions reveals a centering around 0.1. This finding suggests the potential presence of a downward bias in our original estimates. As such, we advise a more cautious interpretation of the previously established results for non-residential buildings.

6 Conclusion

In this paper, we investigate whether municipalities that experience the entrance of Green Party members exhibit a decrease in building permissions. Using a series of staggered difference-in-differences models, we find that the presence of Green Party members has a negative impact on both residential and non-residential building permissions, although the results for non-residential buildings are less robust. The short-term reduction in building permissions is accompanied by a decrease in permitted living space and apartments. Additionally, our findings indicate that municipalities with a Green mayor in power have lower permissions for residential buildings, suggesting that these municipalities are more restrictive in granting permits for residential construction compared to municipalities without a mayor following an explicit environmentalist agenda. However, these additional results do not extend to non-residential buildings, and their external validity is limited due to the small number of municipalities that were exposed to Green mayors.

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Appendix

A.1 Spatial planning in Germany

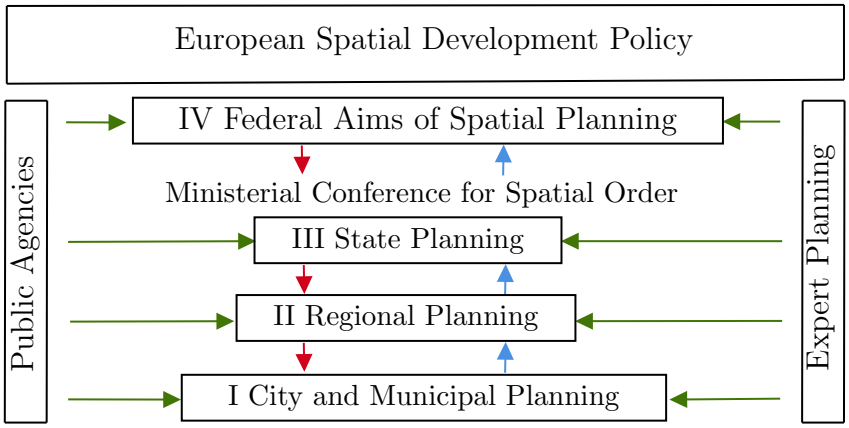


Figure A1: LEGISLATIVE LEVELS OF SPATIAL PLANNING IN GERMANY. This figure is based on the illustration by Miosga and Norck (2017).

As a response to the goal of balanced development and the significant disparities between European regions, spatial development policy has emerged as a core focus in European politics. In 1999, an informal committee of ministers responsible for spatial organization within the European Commission reached a consensus on the European Spatial Development Perspective (ESDP). This non-legally binding orientation framework primarily pursues two objectives: supporting economically underdeveloped regions (balancing objectives) and bolstering regions crucial for global competitiveness (growth objectives). Financial assistance for regions through structural funds constitutes more than one-third of the EU budget, making it the second largest allocation after agricultural funding. When regions apply for such funds, they must submit a development plan outlining concrete measures, including, for example, information about specific planned infrastructure projects. Additionally, regions are required to contribute financially to the respective projects they propose (Kräte, 2013).

The *Raumordnungsgesetz* (ROG) serves as the legal foundation for spatial planning at the German state level. Its primary aim is to strike a balance between social, economic, and ecological spatial needs. One key environmental principle outlined in the ROG (§ 2 section 2 nr. 6) is the preference for utilizing previously used land, thereby avoiding the sealing of additional land. Much like the influence exerted at the European level, the highest tier of government in Germany indirectly impacts municipal spatial distribution through the establishment of guidelines for subordinate levels (Miosga and Norck, 2017).

The Ministerial Conference of Spatial Order (*Ministerkonferenz für Raumordnung*) plays a crucial role in coordinating state and federal spatial planning. This conference comprises the

federal minister and state ministers responsible for spatial planning.[10] The participants discuss and develop fundamental political issues related to spatial planning (Miosga and Norck, 2017). Although their recommendations carry political weight, they are not legally binding.

The legal basis for federal spatial planning is provided by the Landesplanungsgesetze (LPG) at the federal level. These land use planning acts define the regulatory framework, tasks, organization, processes, and instruments of federal spatial planning. They may deviate from the ROG, as is the case for the Bavarian law (*Bayerisches Landesplanungsgesetz*). These laws result in statewide federal spatial order plans (*Raumordnungspläne* or *Landesentwicklungsprogramme*), which are documents that contain schemes of goals and principles in the form of text and maps, depicting how space should be organized and developed. In the Bavarian version, goals for sustainable development of residential areas are included. These guidelines specify that public services, living space, and employment opportunities should be provided in sufficient quantity, and that the assignment of building areas should take demographic developments and the characteristics of the particular region into account. At the same time, the assignment of areas for buildings should, in principle, be parsimonious to limit land usage increase (Miosga and Norck, 2017).

The Bavarian state government has identified the reduction of land usage and the promotion of circular land use economy (*Flaechenkreislaufwirtschaft*) as a long-term goal in their sustainability strategy, the *Bayerische Nachhaltigkeitsstrategie 2017*. Consistent with the German federal government and the coalition agreement, the Bavarian government aims to limit land usage to 5 ha daily by 2030, which will be reflected in the land use planning act (*Landesplanungsgesetze*) (Bayerisches Staatsministerium für Umwelt und Verbraucherschutz, 2018). The Greens and the OEDP are particularly in favor of achieving this target in the short term, as noted in section 2.3. Compared to other federal states such as Thuringia, the Bavarian land use planning act is less specific regarding settlement guidelines. (Miosga and Norck, 2017).

According to state law (ROG), each federal state must develop spatial plans for its subregions (II), in accordance with the respective federal spatial laws (*Landesplanungsgesetze*). In Bavaria, regional planning authorities (*Planungsverbaende*) are responsible for developing these plans in collaboration with the district governments (*Bezirksregierungen*) that cover several counties (*Kreise*) and municipalities (*Gemeinden*). These plans are more detailed than the spatial order plans (*Landesentwicklungsprogramme*), including objectives related to settlement and unsealed areas, as well as area allocation for infrastructure. However, similar to the spatial order plans, these specifications are rather general. Typically, subregional spatial plans do not identify specific areas, but rather set out guiding principles such as distinct measures for metropolitan and rural areas. For densely populated and still growing areas, the focus is on cre-

[10]Since 2018, this has been overseen by the Federal Ministry of the Interior, Building and Homeland (*Bundesministerium des Innern, für Bau und Heimat*), headed by Horst Seehofer.

ating new living spaces. In areas with negative migration balances or low population density, the main issues are preventing empty buildings and reducing public service capacity (Miosga and Norck, 2017).

Expert planning (groups) (*Fachplanungen*)[11] and the public agencies (*Traeger oeffentlicher Belange*) are further influential entities (Miosga and Norck, 2017).

In line with the subsidiarity principle, municipal spatial planning (I) is the most concrete level of spatial design, which is regulated in the *Baugesetzbuch* (BauGB). As all planning levels, local spatial planning should be oriented upon a common or public good. This means that the planning decisions should increase public welfare of the particular municipality. According to §1, section 5, (BauGB), sustainable municipal development is defined as reconciling social, economical, environmental demands, as well as the interests of future generations (Miosga and Norck, 2017).

Technically, land use planning (*Bauleitplanung*) at the municipal level is organized as a two-step procedure. First, the preparatory planning (*Vorbereitende Bauleitplanung*) takes place, leading to a zoning or land use plan (*Flaechennutzungsplan* (FNP)). Second, the building plan (*Bebauungsplan* (BBP)) is developed, which is the binding planning (*Verbindliche Bauleitplanung*). The FNP covers the total municipal area and contains rather unspecific information about future land use categories of the particular municipality, such as living, industrial, or forest areas. The more concrete BBP is developed on the basis of the FNP for different parts of the municipality. Nevertheless, the BBP should not deviate from the allocation of the general land use categories defined in the FNP (Middeke, 2013).

Ultimately, the municipal council decides on both building plans, FNP and BBP, and the final versions need to be signed by the mayor (Middeke, 2013, 10/VII). Planned buildings have to be granted with a municipal accord (*Gemeindliches Einvernehmen*), if they deviate from the BBP, or if the building control authority (*Bauaufsichtsbehoerde*) legally is part of the municipality (Weber and Köppert, 2019). In these cases, the municipal council has to make a decision within two months, otherwise the accord is considered as granted (Dürr and Schulte Beerbühl, 2018).

Another institutional instrument municipalities are in charge of is the development freeze (*Veraenderungssperre*). This tool allows municipalities to freeze a building permission process up to four years. Typically, it lasts around two years. However, as the municipal accord, a construction freeze needs to be justified legally. An application of both tools due to political reasons is not allowed (Martin, 2017). Nevertheless, in principle a manipulation due to political reasons might be observable.[12]

[11] Including, for example, agrarian, forestry, traffic, or garbage disposal specialist planning

[12] From qualitative municipal council protocol analysis I can confirm this.

To sum up, for influencing land usage and building structure, municipality councils are in charge of four tools. On the one hand, councils decide upon the long-term land use plan (FNP, §5, section 1.1, BauGB) and the more concrete and short-term construction plan (BBP, §8 section 1.1 BauGB). Both can be referred to as macro tools of spatial planning. On the other hand, the municipal accord (*Gemeindliches Einvernehmen*, §36 BauGB) and the development freeze (*Veraenderungssperre*, §14,15 BauGB) are considered as micro instruments of spatial shaping (Martin, 2017).

A.2 Figures and tables

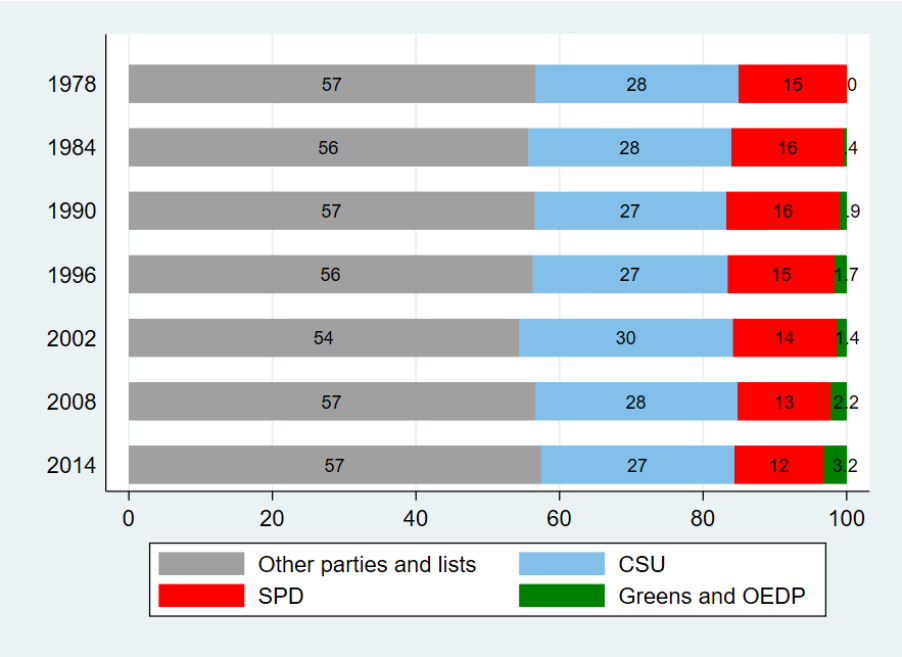


Figure A2: SHARES OF SEATS IN BAVARIAN MUNICIPAL COUNCILS (1978-2014). This Figure A2 shows the percentage shares of seats held by different political parties in the last seven legislature periods at the local level, covering 2,056 municipalities in total. The figure indicates that a strong conservative block holds approximately 80% of the seats, while a smaller center-left (SPD) and environmental party block holds the remaining seats. The Greens and OEDP gained a substantial number of seats from 1990 to 2014, increasing from a share of 0.4% to 3.2%.

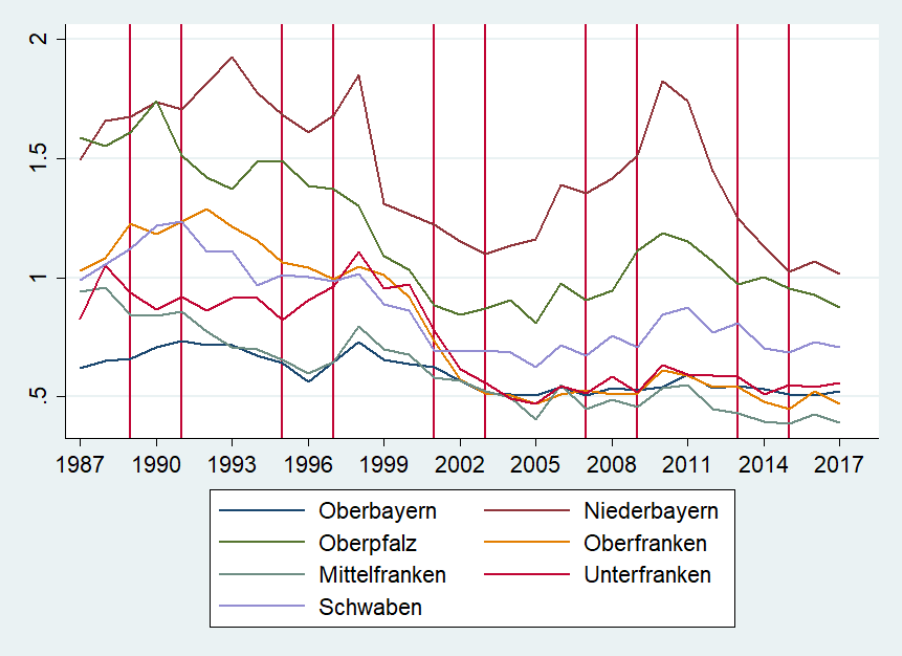


Figure A3: PERMITTED NON-RESIDENTIAL BUILDINGS PER 1,000 INHABITANTS (1987-2021). This figure displays permitted non-residential buildings per 1,000 inhabitants at the level of the 7 administrative districts of the Bavarian state over the period. The vertical red lines indicate election years.

Table A1: SUMMARY STATISTICS

Population category	**<1,000**			**1,000 ≤ inhabitants ≤ 20,000**			**> 20,000**		
Variable	**Obs.**	**Mean**	**Std. Dev.**	**Obs.**	**Mean**	**Std. Dev.**	**Obs.**	**Mean**	**Std. Dev.**
Urban area share (ALKIS)	1070	0.077	0.029	12891	0.11	0.068	4543	0.108	0.092
Builtup area share (Daytime satellite data)	4980	0.019	0.024	60587	0.046	0.051	8269	0.139	0.204
Unsealed area share (ALKIS)	1070	0.923	0.029	12891	0.89	0.068	4543	0.892	0.092
Permitted dwellings	5276	2.822	2.852	64433	12.496	13.137	10475	33.512	98.25
Permitted non-resdiential buildings	5276	1.415	1.542	64433	4.185	4.331	10475	9.238	27.608
Property price (Euro per sqm)	863	53.17	44.034	24975	126.97	157.089	4576	144.76	212.886
House price index	43	43.882	47.771	13356	25.5	68.926	974	80.523	79.037
Population	5276	833.024	133.563	64433	4107.216	3562.679	2251	71765.402	170326.642
Unemployment share	2017	0.013	0.005	25793	0.015	0.006	974	0.023	0.007
Debt (Euro, thousands)	5276	431.697	477.004	64433	2631.898	3860.257	20755	12041.502	95818.183
Property tax B	5276	340.838	65.776	64433	322.333	49.758	16639	305.165	53.076
Business tax	5276	323.307	28.742	64433	324.953	25.479	16639	319.928	29.783
Treated	5276	0.001	0.031	64433	0.127	0.332	20755	0.1	0.3
Ever treated	5276	0.01	0.102	64433	0.325	0.468	20755	0.394	0.489

Notes: This table displays summary statistics of relevant variables from 1987 to 2019, grouped by population categories. The regression analysis utilizes a subsample of municipalities falling within the second category (1,000-20,000 inhabitants). On average, a municipality in this subsample has around 4,107 inhabitants. The average of permitted dwellings is 12.5 per year, which corresponds to around 600 sqm of living space per 1,000 inhabitants. The average price per sqm of land ready to be built on (*Baureifes Land*) is 126.97 Euro. Note that Bavaria has the lowest unemployment rates among German states, which explains the calculated share of only 1.5% unemployment. Taxes are depicted as assessment rates (*Hebesaetze*).

Table A2: TREATED VS. CONTROL MUNICIPALITIES

Group		**Control**			**Treated**		
Variable	**Obs.**	**Mean**	**Std. Dev.**	**Obs.**	**Mean**	**Std. Dev.**	**Test**
Urban area share (ALKIS)	8692	0.098	0.054	4199	0.133	0.087	F= 798.447***
Builtup area share (Daytime satellite data)	39641	0.04	0.046	19109	0.06	0.058	F= 2132.788***
Unsealed area share (ALKIS)	8692	0.902	0.054	4199	0.867	0.087	F= 798.447***
Permitted dwellings	41007	9.182	9.895	19743	19.379	16.258	F= 9118.326***
Permitted non-resdiential buildings	41007	3.533	3.658	19743	5.667	5.289	F= 3347.342***
Property price (Euro per sqm)	14588	87.59	90.659	9427	178.025	192.934	F= 2388.959***
House price index	6104	1.292	50.192	5581	44.347	72.252	F= 1418.733***
Population	41007	2814.927	2080.154	19743	6767.079	4410.564	F= 22521.23***
Unemployment share	14971	0.014	0.006	7139	0.015	0.006	F= 97.817***
Debt (Euro, thousands)	41007	1779.305	2245.431	19743	4357.223	5463.552	F= 6758.506***
Property tax B	41007	325.051	50.905	19743	312.258	45.235	F= 903.412***
Business tax	41007	323.246	24.53	19743	325.842	26.074	F= 143.228***

Notes: This table compares the number of observations, the mean, and the standard deviation of treated and control municipalities. Moreover, this table provides a group F-test on municipality characteristics to compare minister and control municipalities. Stars indicate significance levels at 10%(*), 5%(**) and 1%(***).

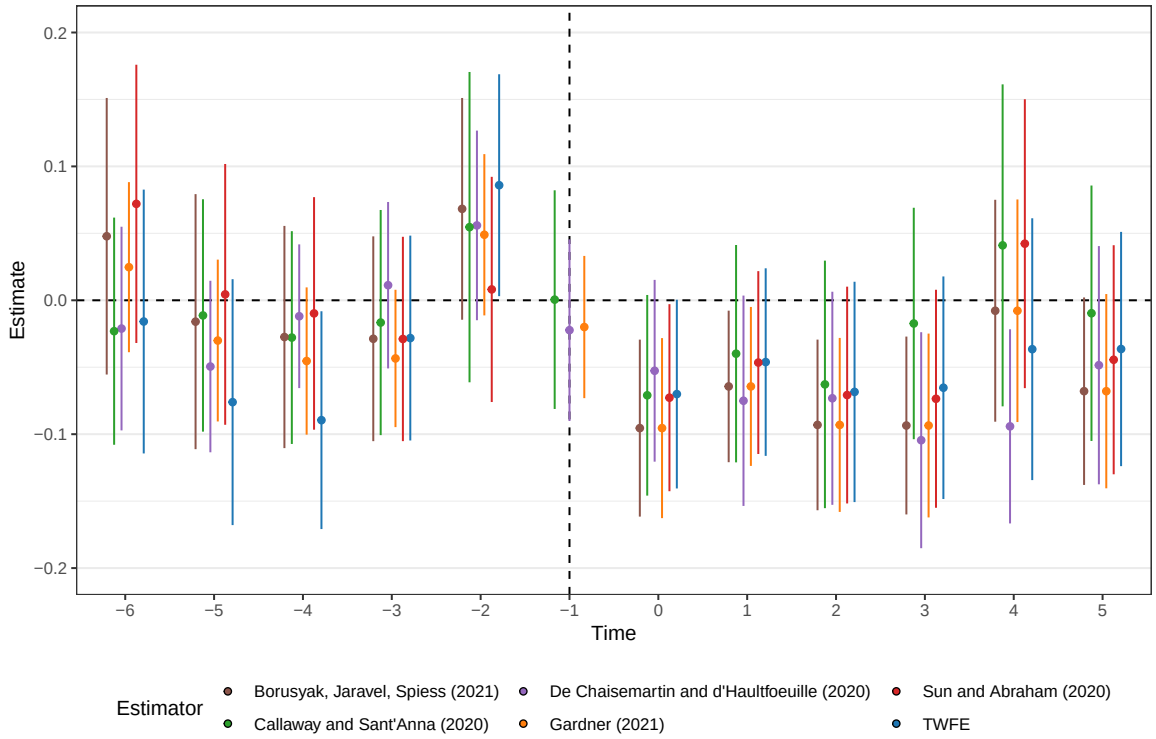


Figure A4: EVENT-STUDY ON GREEN PARTY PRESENCE AND RESIDENTIAL BUILDING PERMISSIONS INCLUDING COVARIATES. This figure displays the event-study plots generated using six different estimators to examine the impact of treatment on the log of residential building permissions. The covariates included in the estimations are population counts, total debt, property and business tax rates, and log of built up area. The utilized estimators are the dynamic version of the TWFE model (blue), Gardner (2022) (red), Sun and Abraham (2021) (red), Callaway and Sant'Anna (2021) (green), De Chaisemartin and d'Haultfoeuille (2020) (purple), and Borusyak, Jaravel, and Spiess (2021) (brown). To compute these estimates we used the *did2s* and *did_multiplegt* R packages. The comparison groups are defined by the default settings: not-yet and never treated entities (municipalities). The x-axis represents the time variable, which is measured in years, and the vertical reference line indicates the last pre-treatment year. The y-axis represents the estimates for log of building permissions. The bars on the plot represent 95 percent confidence intervals, with standard errors clustered at the municipal level.

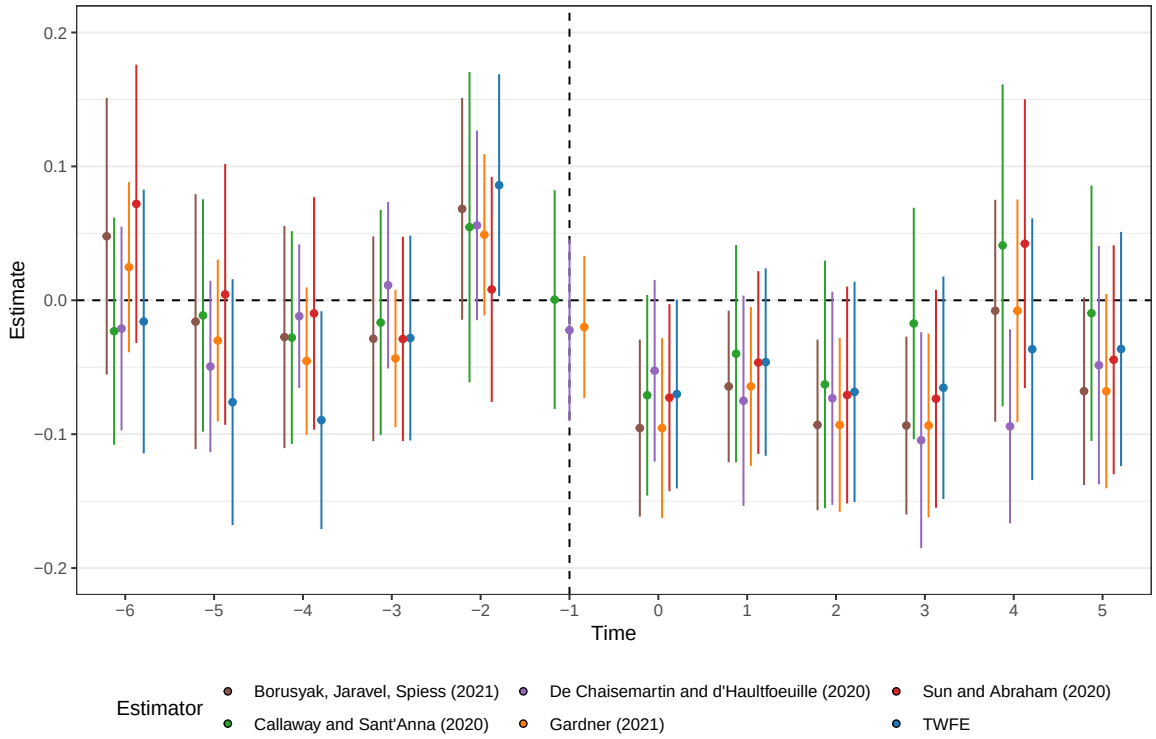


Figure A5: EVENT-STUDY ON GREEN PARTY PRESENCE AND NON-RESIDENTIAL BUILDING PERMISSIONS INCLUDING COVARIATES. This figure displays the event-study plots generated using six different estimators to examine the impact of treatment on the log of non-residential building permissions. The covariates included in the estimations are population counts, total debt, property and business tax rates, and log of built up area. The utilized estimators are the dynamic version of the TWFE model (blue), Gardner (2022) (red), Sun and Abraham (2021) (red), Callaway and Sant'Anna (2021) (green), De Chaisemartin and d'Haultfoeuille (2020) (purple), and Borusyak, Jaravel, and Spiess (2021) (brown). To compute these estimates we used the *did2s* and *did_multiplegt* R packages. The comparison groups are defined by the default settings: not-yet and never treated entities (municipalities). The x-axis represents the time variable, which is measured in years, and the vertical reference line indicates the last pre-treatment year. The y-axis represents the estimates for log of building permissions. The bars on the plot represent 95 percent confidence intervals, with standard errors clustered at the municipal level.

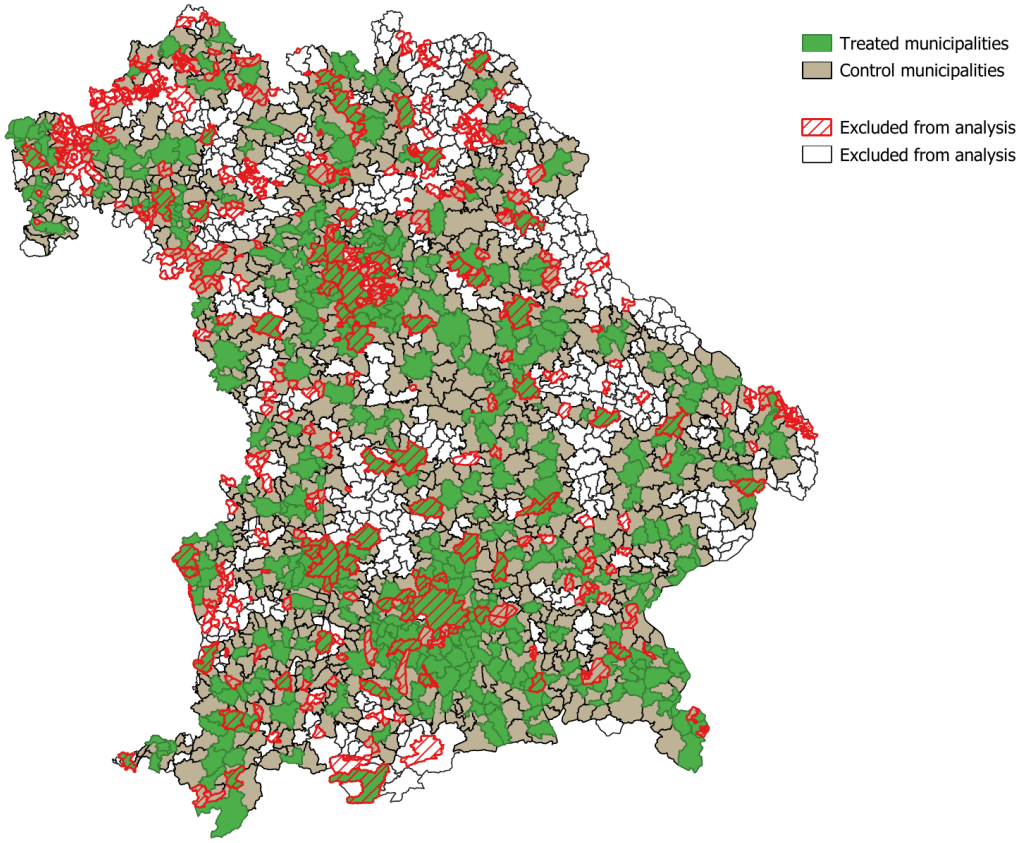
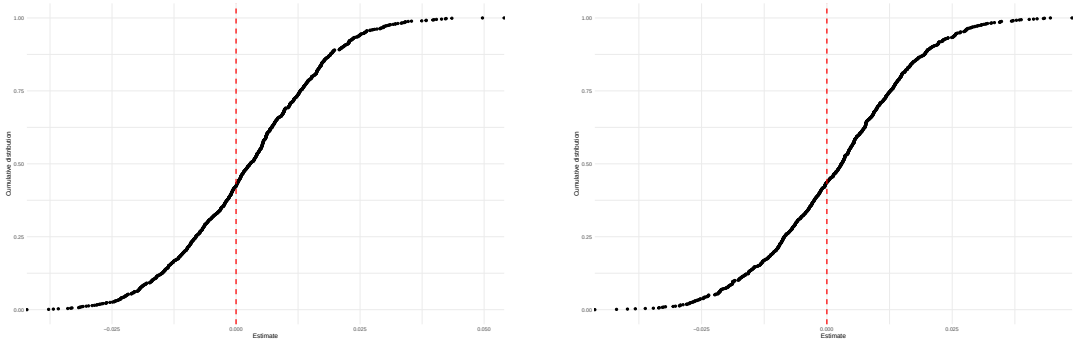
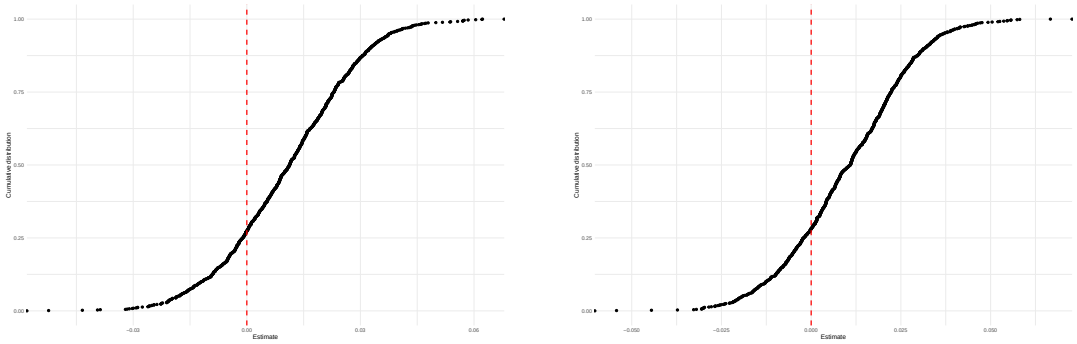


Figure A6: ALTERNATIVE CONTROL GROUP. This map indicates indicates municipalities where the Green Party at least once gained a seat in the local council during our period of investigation (1987-2019) and the neighboring municipalities. The restricted sample described in Section 5.3.3 only consists of the green and brown shaded municipalities (1,250 in total).



(a) Exclusive covariates **(b)** Inclusive covariates

Figure A7: PLACEBO REGRESSIONS FOR RESIDENTIAL BUILDINGS. This figure collects placebo regressions results regarding the effect of treated municipalities on residential buildings. For this, we rely on a sample that excludes the 409 treated municipalities. Within this sample of 1,515 originally untreated municipalities, we randomly assign 300 municipalities with staggered timing to the treatment group and re-estimate the regressions reported in Table 2, columns 3 and 4. We estimate 1,000 such placebo regressions and plot the cumulative distribution of the coefficient estimates (black dots) in the above figures.



(a) Exclusive covariates **(b)** Inclusive covariates

Figure A8: PLACEBO REGRESSIONS FOR NON-RESIDENTIAL BUILDINGS. This figure collects placebo regressions results regarding the effect of treated municipalities on non-residential buildings. For this, we rely on a sample that excludes the 409 treated municipalities. Within this sample of 1,515 originally untreated municipalities, we randomly assign 300 municipalities with staggered timing to the treatment group and re-estimate the regressions reported in Table 3, columns 3 and 4. We estimate 1,000 such placebo regressions and plot the cumulative distribution of the coefficient estimates (black dots) in the above figures.

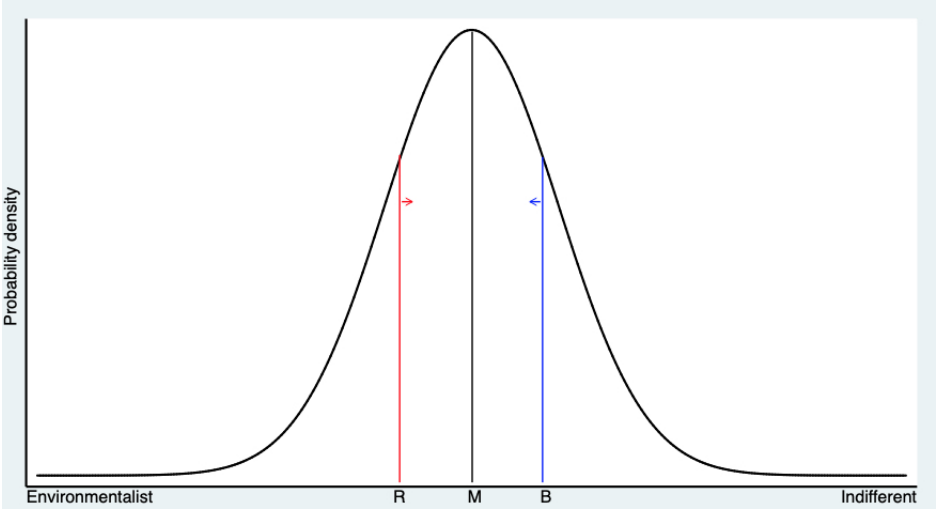


Figure A9: Median voter model with environmental dimension.