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**Does competition spur social media deployment among local governments?
evidence from the deployment of Facebook in the German state of Hesse**

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Abstract

We analyze the decision of local governments to deploy social media. We argue that – by deploying social media – governments send a signal of modernity, transparency and openness for dialogue to their citizens. We apply a hazard model to panel data on municipalities in the German state of Hesse ($n = 422$) and their appearance on Facebook between 2010 and 2019. Our main research question is: Does competitive pressure drive social media deployment? We find intense competition for mobile residents to promote social media deployment while no effect is found for tax competition. Facebook pages are more likely to emerge in years preceding mayoral elections as predicted by the theory of party competition with myopic voters. In line with the theory of yardstick competition, we find the probability that a certain municipality launches a Facebook page to increase in the number of its neighbors being present on Facebook.

JEL: H71, H83, R50

Keywords: social media deployment, Facebook, local government, inter-jurisdictional competition, elections, Germany, hazard models

Declaration of interest: none

1. Introduction

Social media is a means by which governments can uni-directionally spread information quickly, explain their policies and reach citizens that are difficult to reach by traditional means (Mergel, 2013; Mossberger et al., 2013). More importantly, social media facilitates bi-directional exchange between governments and citizens (e.g., Criado et al., 2013; Steinbach et al., 2019). It enables citizens to voice their opinion about existing public services, influence the political agenda and discuss possible changes with government officials and among each other (e.g., Bonsón et al., 2012; Larsson, 2013; Steinbach et al., 2019). Many scholars argue that these new forms of interaction – if applied properly – improve transparency, openness and accountability of government (e.g., Bonsón et al., 2012; Oliveira and Welch, 2013; Sobaci, 2016). Some scholars also point at the role of social media in facilitating co-production of public services (e.g., Sorrentino et al., 2018). Typical examples include the organization of childcare or mobility in rural areas, the provision of information about illegally disposed (bulky) waste and damage in the road surface.

In most countries, federal governments and other public agencies operating at the national level are present on social media nowadays (e.g., Gulati et al., 2014; Weber, 2018). At the local level of government, however, public social media deployment has been spreading only gradually (e.g., Larsson, 2013; Faber et al., 2020; see also section 2). This is somewhat surprising because many issues decided at this level are particularly suitable for an active involvement of citizens (e.g., Sorrentino et al., 2018). Moreover, the proximity of voters and public authorities at the local level has created a tradition of citizens' participation in pre-digital times (e.g., Oates, 1972; Mossberger et al., 2013). Finally, the examples for public services where social media empowers co-production typically refer to local public services.

A number of studies analyze the deployment of social media among local governments using different methods and data from different regions and social media platforms (see section 2).

They find Facebook and Twitter to be the most widely used platforms and larger cities to be more likely to deploy social media. Population density and a high quality internet connection are found to increase the probability that a municipality deploys social media (e.g., Larsson, 2013, Faber et al., 2020) while fiscal stress reduces this probability (Guillamon et al., 2016).

This paper adds to this strand of literature in two ways. First, we take a distinctly economic approach and ask: Does competitive pressure drive municipalities towards deploying social media? This question has received little if any attention so far. We interpret the deployment of social media as a signal of openness, transparency and modernity that local government officials sends to their stakeholder (e.g., Faber et al., 2020) and argue that competitive pressure increases the incentives for local governments to send this signal. We account for inter-jurisdictional competition for mobile capital and residents as well as for electoral competition and the role of mayoral elections. Finally, we analyze the spatial pattern of social media deployment and test whether a certain municipality's presence on social media depends on the social media deployment of its neighbors. The second contribution is a methodological one. Following our interpretation of social media deployment as a signal to local stakeholders, the incident that requires explanation is the point in time when this signal is first sent, i.e. the social media presence is launched. Hazard models are the suitable method for this purpose (e.g., Allison, 1982; Bischoff et al., 2020). We apply such a model to data on the municipalities in the German state of Hesse ($n = 422$) and their deployment of Facebook in the period of 2010 to 2019.

We find support for the notion that electoral concerns and yardstick competition drive municipalities' deployment of social media. The effect of inter-jurisdictional competition is inconclusive. The likelihood to launch a page on Facebook increases in the mobility of and thus competition for local residents. However, it is not found to increase in the intensity of tax competition. Instead, social media deployment increases in local tax rates – especially in the rate on real estate. These effects are stable over a range of specifications and of sizeable magnitude.

The paper proceeds as follows: Section 2 reviews the relevant literature. Section 3 discusses the impact of competitive pressure on social media deployment and derives our hypotheses. The institutional background and the data is described in section 4. Section 5 presents our empirical strategy and results. Section 6 discusses these results before section 7 concludes.

2. Review of literature

There is a number of studies exploring the driving factors behind the deployment of social media by local governments. The studies cover different regions and countries – including Sweden (Larsson, 2013), Nebraska (Oliveira and Welch, 2013), Israel (Levi-On and Steinfeld, 2015), Spain and Italy (Guillamón et al., 2016) and the Netherlands (Faber et al., 2020). Some studies focus on a single social media platform (mostly Facebook or Twitter) while others analyze social media deployment of multiple platforms with the aforementioned being included in virtually all of these studies (e.g., Hofmann et al., 2013; Mossberger et al., 2013; Oliveira and Welch, 2013; Guillamón et al., 2016; Faber et al., 2020). The studies differ with respect to their dependent variables. Most studies develop measures that capture the activity level of local governments on social media and relate these measures to municipal characteristics in a multiple regression. The data sets employed are cross-sectional and the number of explanatory variables is usually limited. The studies by Guillamón et al. (2016) and Gao and Lee (2017) pose exceptions in this respect. They include fiscal variables and a number of additional variables capturing the characteristics of the local electorate and council. The existing studies generally support a positive relationship between social-media deployment and municipal size. Faber et al. (2020) find densely populated Dutch municipalities to be more likely to deploy social media early. Larsson (2013) finds a positive relationship between the availability of fast internet and the likelihood that Swedish municipalities are present on Facebook. He also analyzes the role of voter turnout as a proxy for the pre-existent relationship between citizens and their municipality

but finds it to be insignificant. Large-scale studies about the factors driving social media deployment among German municipalities are lacking.

A related strand of literature focusses on the adoption of e-government among local governments. A special focus rests on official governmental websites with or without transactional properties (e.g., Feeney and Brown, 2017). The lack of these resources is found to be a major barrier for expansion of e-government (Moon, 2002; Moon and Norris, 2005). Musso et al. (2010) find that larger cities with wealthier and more politically active population adopt e-government practices earlier. They also find that the population in the early-adopter cities is on average older, better educated, with higher median income and higher socioeconomic status. Municipalities with a professional council-manager government - who are assumed to put an emphasis on innovativeness and efficiency - are more likely to be adopt e-government earlier than municipalities with an elected mayor-council government (Moon, 2002). In the United States cities and counties in metropolitan areas are found to adopt e-government earlier than jurisdiction in suburban and peripheral areas (Norris and Moon, 2005).

A third strand of relevant literature focusses on the role of social media in electoral competition. The power of social media has been impressively demonstrated by the electoral campaigns of Barack Obama (e.g., Bennett, 2012; Zhuravskaya et al., *forthc.*). These and campaigns of numerous candidates from other parties and other countries have been analyzed in the political science literature. The studies cover both national and subnational elections (e.g., Lilleker et al., 2011; Larsson, 2013; Vergeer and Hermans, 2013; Ceron and d'Adda, 2016; Quinlan et al., 2018). Facebook and Twitter are the most commonly used platforms and they are found to host distinctly different audiences (e.g., Larsson, 2015; Quinlan et al., 2018). Social media deployment by political parties and candidates is generally found to have a positive impact on the

voter turnout (e.g., Vergeer and Hermans, 2013). Challengers and underdogs make more intensive use of social media (e.g., Larsson, 2015; Turnbull-Dugarte, 2019) and older politicians deploy social media less frequently (e.g., Larsson and Kalsnes, 2014).

Like the first two strands of literature reviewed above, we focus on the behavior of local governments rather than of parties or candidates. At the same time, the upcoming analysis differs significantly from the corresponding studies. First, we interpret the act of launching a social media presence to be a strategic signal sent by the local authorities – with the primary addressees being the resident population and local firms. Thus, we focus on the decision of local authorities to become present on social media while we are less interested in explaining their activities on social media once they are present. We ask why some send the strategic signal earlier while some sent it later (or not at all). Our dependent variable is more crude than the one used in other studies. The more crude nature of our dependent variable enables us to cover a larger number of municipalities and observe their behavior over a longer period of time while the existing studies largely employ cross-sectional data. The panel structure of our data allows us to reveal general regularities and test for a large number of different forces driving social media deployment. We take a distinctly economic perspective and focus on the role of competitive pressure on social media deployment – a driving factor that has not been analyzed so far.

3. Hypotheses

The literature reviewed above takes it that the deployment of social media is a tool to achieve a more transparent, open government and facilitate higher citizen participation. This is likely to be popular among citizens and other local stakeholders. Launching a presence on social media entails only small investment costs (e.g., Oliveira and Welch, 2013) but being active on social media requires a continuous time effort and thus entails significant running costs (e.g., Faber et al., 2020). More importantly, the administrative staff in charge of communicating via social media is likely to incur substantial psychological change costs because employees are expected

to adapt to a new, less formalized and less hierarchical form of communication with citizens (e.g. Rose and Grant, 2010; Juell-Skielse et al., 2017). These change costs may result in considerable resistance among the administrative staff. The economic theory of bureaucracy argues that incentives for the heads of the administration to overcome such resistance and incur the costs of change depend on the competitive pressure they face (e.g., Wintrobe, 1997; Moe, 2006; Salmon, 2006; Baskaran et al, 2016). The higher this pressure is, the more willing the heads of the administration are to overcome the resistance and become present on social media.

Local governments face competition in multiple arenas. For once, municipalities compete with other municipalities for mobile capital (e.g., Zodrow and Miezowski, 1986; Wilson, 1999). In recent years, especially rural municipalities face an intense competition for residents. Municipal tax rates, infrastructure and amenities are important tools used in this competition (e.g., Taylor, 1992; Salmon, 2006). We argue that social media deployment may represent a new instrument in this competition. In the long run, municipalities present on social media provide their residents with the benefits from co-production of local services and a more intensive interaction between governments and citizens. Other things equal, this makes the municipality more attractive to citizens and firms and strengthens their position in inter-local competition. In the short run, the act of launching a social media site serves as a signal of modernity, transparency and openness (e.g., Faber et al., 2020). The incentive to send this signal, be present on social media and incur the change costs within the local administration increase in the degree of inter-jurisdictional competition the municipality finds itself in. Thus, we arrive at our first hypothesis:

Hypothesis 1: Social media deployment as a signal to residents and local firms

Municipalities facing intense inter-jurisdictional competition are more likely to deploy social media than municipalities facing less intensive inter-jurisdictional competition.

Based on a survey among 332 German municipalities and counties, Drüke et al. (2016) show that the mayor's offices are among the primary forces pushing towards the launch of an official

social media page of their jurisdiction. Given that German mayors are directly elected by local residents, it is worthwhile to adopt a Public Choice perspective and consider the role of incumbents and their struggle for re-election. The Public Choice literature has a long tradition of interpreting the incumbents' policy choices as signals to the voters. The signature either conveys information about their competence (e.g., Rogoff and Sibert, 1998; Brollo et al., 2013) or about their preferences (e.g., Drazen and Eslava, 2010). By bringing his/her municipality to social media, the incumbent may signal his/her competence as a public manager as well as his/her preference for openness and transparency to the voters. Moreover, the municipality's social-media page may serve as an additional tool to advertise the achievements of the municipal administration under his/her leadership. As voters are myopic (e.g., Nannestad and Paldam, 1994; Lewis-Beck and Stegmaier, 2019), sending this signal and opening the communication channel is especially useful in times close to elections. This leads to our second hypothesis:

Hypothesis 2: Social media deployment in the election cycle

Municipalities are more likely to deploy social media in years prior to mayoral election than in years where the next mayoral election is distant.

Finally, geographic proximity plays a crucial role in inter-jurisdictional competition (e.g., Rivelli, 2001). The conventional theories of inter-jurisdictional competition – especially the literature on tax competition – argue that proximity matters because the costs of mobility are assumed to increase in distance. Thus, the neighboring municipalities are important competitors (e.g., Rivelli, 2001; Bischoff and Krabel, 2017). The theory of yardstick competition points at an additional reason for the relevance of geographical proximity (e.g. Besley and Case, 1995). Accordingly, citizens are using the performance of local governments in neighboring jurisdictions as a yardstick to evaluate their own government. If the own government performs poorly in this comparison, citizens are unlikely to re-elect the incumbent. We argue that social media deployment is a category that voters account for when assessing the performance of their own

government – e.g. with respect to its modernity and openness. Therefore, the logic of yardstick competition applies to the emergence of social media deployment. Given the extremely low costs of “looking across the fence” when it comes to municipal activities on social media, it seems reasonable to assume that the social media presence of a municipality will impact the decision of its neighbors to deploy social media. This leads to our third hypothesis:

Hypothesis 3: Yardstick competition and social media deployment

Municipalities are more likely to deploy social media the more of its neighbors deploy social media.

4. Institutional background and data

The current analysis use data on the West-German state of Hesse (21.100 km², 6 mill. population). The 422 Hessian municipalities provide important public services like local roads, business parks, cultural infrastructure and pre-school childcare. More than 50 percent of municipal revenues come from state grants and vertical tax sharing. State grants are dominated by unconditional grants distributed through a formula-based fiscal equalization system (Bischoff and Krabel, 2017). Hessian municipalities collect local business and land taxes. They also decide about the tax multiplier (“Hebesatz”) that fixes the effective rate on the profits of local business establishments (business taxes) and on the ratable value of real estate (land tax).¹ Even after fiscal equalization, the marginal contribution of these taxes to the overall municipal budget remains significant (e.g. Bischoff and Krabel, 2017).

The constitution guarantees municipalities the right of self-government. The mayor is elected directly by the citizens and his/her term runs for six years (no term limits). He/she is accountable to a municipal council. Council members are elected by the local residents. Unlike the elections

¹ Next to the tax levied on residential and firm buildings and land (so-called land tax B) that we concentrate on in this paper, there is a negligible tax on land and buildings in farming and forestry (land tax A).

for the municipal council, mayoral elections are not synchronized. Thus, every year in our period of observation sees a number of mayoral elections.

Regarding the use of information and communication technology and social media by citizens and governments, Germany takes a middle position among the developed western democracies (e.g., Weber, 2018). Facebook is the most widely spread social media platform in Germany. In 2019, Facebook had approximately 38 Million so-called monthly active users². A German version of Facebook went online in 2008. By 2019, 206 municipalities had launched an official Facebook page. We consider a Facebook page to be the official representation of a particular municipality if there is a direct link to it on the municipality's homepage and/or the municipal administration is unequivocally identifiable as the profile's owner.³

Figure 1 shows that the deployment of Facebook began in 2009, reached its peak in 2011 and then remained moderately high. None of the municipalities that start to be present on Facebook deactivated their page later. Figure 2 shows that the emergence of Facebook pages across the state Hesse. Municipalities that entertain a Facebook page are marked in color with the early adopters being darker than the late adopters. The map shows that Facebook pages exist in all regions of Hesse though there seems to be some regional clustering.

[Figure 1 and 2 about here]

² <https://www.statista.com/statistics/1017402/facebook-users-germany/>

³ Facebook pages of the municipalities were identified through a keyword search on Facebook. We exclude public groups and organizations that also use the municipality's name in their profile name but have no connection to the town hall. Some municipalities also use Facebook groups to communicate with citizens and organize co-production. We account for their role in the sensitivity analyses (see section 5.2). The Facebook pages were predominantly launched in March, September and October.

The purpose of our analysis is to learn more about the factors behind this pattern, i.e. the factors that make some municipalities adopt Facebook early while others adopt it later or not at all. The variables capturing these factors are described below (see also table A.1 in the appendix).

Main explanatory variables

In section 3, we hypothesized that the incentives of a certain municipality m to deploy social media depend on the intensity of inter-jurisdictional competition it faces (hypothesis 1). Bischoff et al. (2020) argue that this intensity can be approximated by looking at the tax multipliers of land tax and local business tax (see also Ly and Paty, 2020): Intense competition forces municipalities to set low tax rates on mobile tax bases (i.e. firms and their profits) and impose high tax rates on immobile tax bases (i.e. local real estate and settlements). Thus, hypothesis 1 predicts that municipalities with low business tax rates and high land tax rates are more likely to deploy Facebook at an earlier point in time than municipalities with higher business tax rates and lower land tax rates.

A second dimension of inter-jurisdictional competition refers to mobile residents. Especially rural municipalities are threatened by the emigration of young residents while finding it increasingly difficult to attract new residents (e.g., Bischoff and Wolfschütz, 2020). Hypothesis 1 implies that – other things equal – municipalities that compete more intensively for residents are more likely to deploy social media at an early point in time. We assume that the intensity of competition for residents increases in the mobility of residents. First, we capture this mobility by the rate of net migration (i.e. the difference between emigration and immigration as a share of total population). Second, we calculate the ratio of immigration *plus* emigration to population size. This improper fraction captures the fluctuation in population. The larger these measures, the more intense the competition for mobile residents and thus the larger the incentives to launch a Facebook-page.

The second hypothesis refers to the timing of social media deployment in the election cycle. We capture this by using dummy variables marking the two year prior to the mayoral election.⁴ Finally, we capture the intensity of yardstick competition (Hypothesis 3) a certain municipality m faces by the share of its neighbors that already deploy Facebook. The higher this share, the more likely municipality m itself is to deploy social media.

Control variables

We introduce numerous explanatory variables. The first category of controls pertains to the municipality itself. Following the literature (see section 2), we control for the population size and population density. We control for the age structure of voters by including the share of residents above 64 years, below 18 years and in the age group 18-24 years. Two variables are used to capture municipalities' fiscal capacity. First, we use the per capita revenues from tax sharing (income and value-added tax). This variable also serves as a proxy of per capita income at municipal level. The second measure – the so-called “Realsteueraufbringungskraft” – multiplies the tax base for land and business taxes with the average tax rate in the relevant year, sums up these fictitious tax revenues and divides the sum by total population. This measure approximates the potential revenues a municipality could have raised from local business and land taxes if it had applied the average tax rates of Hessian municipalities. To control for the pre-existing intensity of the ties between citizens and their local government, we include the voter turnout in the preceding local council elections. We account for the availability of fast internet and include the percentage of households within a municipality that have access to 50 Mbits internet. For municipalities that are very attractive for tourists, this attractiveness may be an additional argument to be present on social media. To account for this aspect, we introduce a

⁴ We did not include a dummy marking the election year because this dummy in some cases marks elections that took place before the Facebook page was installed. The results remain stable if we drop these cases.

dummy variable that takes on the value 1 (0 else) for municipalities that contain a touristic site marked with a star in one of the leading German tourist guides (Baedeker, 1997). The dummy variable **BORDER** takes a value of 1 if the respective municipality borders at least one municipality outside of Hesse (0 else). Another dummy variable marks municipalities that witnessed a run-off election in the last mayoral election. This variable serves as a proxy of the intensity of political competition within a municipality. Finally, we control for possible differences in political preferences among the local electorate by including the seatshares of different parties and local initiatives in the local council.

The second category of control variables captures the characteristics of the incumbent mayor. We control for his/her age and sex. We also capture his/her professional experience using the years in office since the year 2000 and control for the mayors' party affiliation. Table 1 presents descriptive statistics for the municipalities included in the analysis. It differentiates between those 206 municipalities that launched a Facebook page at some point in time between 2009 and 2019 and the other 216 municipalities that did not.

[Table 1 about here]

The two groups are similar in most characteristics. Especially with respect to our main explanatory variables, the groups do not differ systematically. However, there are differences in population size, population density, tourist attractions and access to fast internet. Especially the difference in population size is driven by the fact that all bigger cities are present on Facebook by 2019. At the same time, these cities are not always among the first movers.

5. Empiric analysis

5.1 The empirical strategy

Our main research focus rests on the decision to *start* being present on Facebook. Hazard models are an adequate empirical model to analyze the emergence of such incidents. The discrete-

time hazard rate (e.g., Allison, 1982) is defined as the conditional probability of municipality m starting to be present on Facebook in time t while not being on Facebook before.

$$P_{mt} = \Pr[T_m = t | T_m \geq t, x_{mt}] \quad (1)$$

The complementary log-log function reads as follows (Allison, 1982):

$$\log[-\log(1 - P_{mt})] = \alpha_t + \beta' x_{mt} \quad (2)$$

The vector β' captures the effects of the explanatory variables in matrix x_{mt} on the instantaneous probability to launch a page on Facebook. The vector α_t contains constants reflecting the baseline hazard rate for each year (similar to year fixed effects in linear panel models).

5.2 Results

Table 2 reports the regression results for different specifications using different measures for our central explanatory variables. The table reports odds ratios informing us by what (multiplicative) factor the probability that municipality m starts to be present on Facebook in t increases when the corresponding explanatory variable increases. Odds ratios lower than 1 indicate that a factor retards the deployment of Facebook while odds ratios above 1 indicate that a factor accelerates it. Continuous covariates (with the exception of tax multipliers) are expressed in natural logs. Except for the election year dummies and the share of citizens with access to fast internet, all time-variant covariates are lagged by one year to avoid a simultaneity bias. Standard errors are clustered at the municipal level.

The baseline model reported in table 2 uses all variables described above. The tax multiplier for the land tax is significantly larger than 1 while the odds ratio for the tax multiplier for the business is insignificant. The fluctuation rate in residents yields an odds ratio that is significantly higher than 1 while the net migration rate remains insignificant. These results are partially in line with hypothesis H1. In line with hypothesis H2, the probability of launching a

Facebook page is significantly larger in the pre-election year. The share of neighboring municipalities already entertaining a Facebook page has a positive and highly significant effect. This result clearly supports our H3.

Looking at the control variables, we find both fiscal indicators to be highly significant. Higher per capita revenues from tax sharing reduce the probability to launch a Facebook page while the “Realsteueraufbringungskraft” increases it. The likelihood of launching a Facebook page is lower for municipalities hosting a tourist attraction. The likelihood increases in the share of households connected to a 50 Mbits internet connection and it decreases in population density, the shares of residents below 18 and above 64 years as well as in population size. The latter result is at odds with the evidence from previous studies. Among the mayor’s characteristics, only his/her age is significant. The likelihood that a certain municipality launches a Facebook page decreases in the age of the mayor. All other variables are insignificant.

In model 2, we replace the two tax multipliers by the sum of both tax multipliers and by the ratio between land tax multiplier and business tax multiplier. The logic behind this variation is the following: In the baseline model, the land-tax-rate yields a significant coefficient estimator while the coefficient for the business tax rate is insignificant (with values above 1). Given that the tax multipliers are positively correlated, this gives some indication that it is the general level of taxation rather than the intensity of tax competition that drives social media deployment. The two variables introduced in model 2 help us to differentiate between both. The results in column 2 suggest that the likelihood of launching a Facebook page increases in the size of the tax multipliers. The odds ratio for their ratio is higher than 1 yet insignificant. This result does not support hypothesis H1. All the other variables perform like they do in the baseline model.

Bischoff et al. (2020) point out that the intensity of inter-local competition for a certain municipality can also be measured by the tax multipliers of its neighbors. Thus, we rerun the baseline

model but replace the tax-related indicators by the median tax multipliers in the cluster of municipality m and its neighbors (see model 3). Model 4 reruns model 2 in the analogous way – using the sum and ratio of the median tax multipliers in the cluster of municipality m and its neighbors. The median tax multiplier for the business tax becomes significant at the 10 percent level while the fluctuation rate and the dummy for pre-election years drops to the 10 percent level of significance in model 3. Touristic attractions and population density become insignificant in model 3 and 4. All other variables perform like they do in model 1 and 2.

In model 5 and 6, we rerun the first two models but add two additional control variables. First, we include a dummy variable that takes on the value 1 if the local group of at least one major political party (Social Democrats, Christian Democrats, Green Party, Liberal Democrats, Left-wing Socialists, or the recently emergent “Alternative für Deutschland”) entertains a Facebook page (0 else). This variable captures possible inter-municipal differences in the intensity in which Facebook serves as a platform to discuss political issues. In addition, it serves as a proxy for the intensity of political competition within the municipality. Thus, in the context of the current analysis, it may qualify as a bad control variable (e.g., Agrist and Pischke, 2009). Second, we include the share of the working population with a degree in higher education. This variable is not included in the baseline specification because it is highly correlated with other demographic characteristics. The presence of local parties on Facebook increases the likelihood that the corresponding municipality launches a Facebook page while the share of academics is insignificant. The mayor’s age becomes weakly significant as does the dummy capturing local touristic attractions. All other variables perform like they do in model 1 and 2.

In model 7 and 8, we account for the fact that some municipalities use Facebook groups instead of or in addition to Facebook pages to communicate with citizens and organize co-production. We searched for such groups in all Hessian municipalities and found 46 groups that are currently administered by the mayor or a person officially working for the municipalities. In 21

cases, the Facebook-group was launched after the Facebook page. These cases are irrelevant for our analysis because the group does not represent the first time the municipality appears on Facebook. In 10 cases, the group was launched before and in 15 cases, there is a group but no official Facebook page. In model 1 to 6, we ignored these 25 Facebook groups and concentrated on the question whether or not they entertain pages on Facebook. The reason to do so is that we cannot verify whether the administrators who launched the page did so on behalf of the municipality. It may well be that it was initially launched by a private person – possibly a candidate who wanted to become mayor – and was later taken over by municipal staff. Moreover, the mayor or an employee of the municipality administering the group may do so without formal authorization to do so. To ensure that ignoring Facebook groups does not drive our main findings, we rerun model 1 and 2 without the 25 critical municipalities. The results remain stable.⁵

The size of the odds ratios for significant variables informs us about the magnitude of their impact on municipality m 's probability to join Facebook. Let us first look at the role of tax rates. In the baseline model, an increase in the land tax rate by one standard deviation is equivalent to an increase in the odds of launching a Facebook page by 46 percent. An increase in the sum of the land tax and business tax multipliers by one standard deviation is associated with a 56 percent increase in the probability of joining social media. Regarding the competition for mobile residents, we find municipalities with a fluctuation rate that is higher by one standard deviation to be 20 percent more likely to deploy Facebook. The effect of yardstick competition

⁵ We run additional robustness checks. We replace population size with dummy variables capturing different population brackets, voter turnout in municipal council elections by voter turnout at the mayoral elections and net migration rate by the rate of population growth. We also test a number of additional control variables – e.g. the share of agricultural employment to identify rural municipalities, the power of locally dominant firms (e.g., Bischoff and Krabel, 2017) and the special role of medium-size centers “Mittelzentren” in the Hessian system of regional planning. Finally, we. The results reported above prove stable.

is also quite sizeable. Hessian municipalities have on average six neighbors. If one additional neighbor of municipality m joins Facebook, the odds that municipality m itself also joins it increase by 52 percent. Among our control variables, we find that a 10 percent increase in the revenue from tax sharing decreases the probability of launching a Facebook page by 3 percent. While a 10 percent higher “Realsteueraufbringungskraft” increases the odds by 26 percent.

6. Discussion

Our results partially support our first hypothesis according to which inter-jurisdictional competition is an important factor that accelerates the deployment of social media. Municipalities facing more intense competition for mobile residents start a Facebook page earlier. At the same time, the indicators capturing the intensity of tax competition do not perform as expected. Instead, their performance suggests that municipalities that apply high tax rates – especially on local real estate – are more likely to launch a Facebook page early. One way to rationalize this result is to argue that citizens who pay higher taxes demand more openness and transparency in exchange. However, this explanation is ad hoc.

We also find that Facebook pages are more likely to be launched in years preceding mayoral elections. This result supports our second hypothesis stating that electoral concerns on part of the incumbent mayor drive social media deployment. The positive spatial correlation in the deployment of Facebook is in line with our third hypothesis and the underlying concept of yardstick competition (e.g., Besley and Case, 1995).

Let us turn to the control variables. In line with the previous literature, we find that municipalities with younger mayors and faster internet are more likely to deploy social media early. Like Larsson (2013) in his analysis on Swedish municipalities, the deployment of social media is not driven by voter turnout in municipal elections. This result may result from two effects that offset each other. On the one hand, social media can be particularly productive in municipalities with

high voter turnout. On the other hand, the need to involve citizens more actively is higher in municipalities with low voter turnout (e.g., Silva et al., 2019).

The impact of population size is at odds with previous findings. On the one hand, our descriptive statistics show that municipalities who are on social media in 2019 are on average larger than those who are not. On the other hand, our hazard model shows a negative impact of population size social media deployment. We interpret this as follows: Sooner or later – large municipalities are generally present on social media while they are less likely to be among the first-movers. This result clearly supports our decision to use hazard models that exploit the variation across space and time rather than other models that are restricted to cross-sectional variation.

The performance of our fiscal indicators is surprising. We find the revenues from tax sharing to have a negative influence on social media deployment while the opposite is true for the standardized revenues from own taxes. Together with the performance of the local tax-rates, this result supports the notion that municipalities that rely heavily on local taxes are facing more pressure towards openness and citizens' involvement. Again, this explanation is *ad hoc*.

The models 5 and 6 clearly show that municipalities where political parties are active on Facebook are more likely to start an official Facebook page. While this result is not surprising, its interpretation is far from straight-forward. The existence of Facebook pages of political parties at the local level may point at the fact that the citizens in this municipality actively discuss political issues on social media. On the other hand, it may indicate that political competition in this municipality is intense and thus parties need to use all available channels to address the electorate. In fact, the emergence of parties Facebook pages at the local level is in itself an interesting topic for future research.

The current analysis is not without shortcomings. The literature on the use of social media by parties and candidates (see section 2) suggest that a substantial number of mayors and potential challengers have a personal Facebook profile they use to address citizens in election times. We

do not cover this aspect of the mayor's struggle for re-election. Unlike earlier studies, we do not account for differences in the level of activities municipalities show once they are present on social media. Instead, we solely use the information on the year municipalities first appear on Facebook. While this measure is undoubtedly crude, it captures the decision of the local administration to send a signal to its stakeholders. We believe that this decision requires an analytical set-up that differs distinctly from the set-up needed to analyze anything that happens after that. The reason is that interaction on social media is a dynamic process with multiple feedback loops between local governments and different groups of stakeholders. Time-series methods are needed to explain the evolution of social media activities once municipalities start interacting with their stakeholders on social media. Moreover, these models must account for the characteristics of the stakeholders that the local governments interact with. Such an analysis is interesting yet adds little to the primary question we want to address in this paper.

7. Conclusion

We analyze the decisions of local governments to deploy social media (namely Facebook). We interpret the act of launching a Facebook page as a signal sent by the local administration to its citizens and other current and potential stakeholders. Being present on Facebook is interpreted as a signal of modernity, openness, transparency and the willingness to actively involve citizens in the process of local public decision making and co-production of services. Our main focus rests on the following question: Does electoral or inter-jurisdictional competition make municipalities send this signal earlier? This question has not received any attention in the literature on social media deployment among municipal government.

We use panel data for all 422 municipalities in the German state of Hesse between 2010 and 2019. The dependent variable is the year in which municipalities launch an official municipal page on Facebook. Our results show that competitive pressure make municipalities launch an

official Facebook page earlier. By focusing on this rather crude measure of social media deployment, we can cover a large number of municipalities and include a large number of control variables. The approach enables us to apply a hazard model and thereby exploit the variation across municipalities as well as across time. Moreover, we avoid endogeneity problems that emerge when local governments' emergence on social media and their subsequent activities on these platforms is analyzed simultaneously.

Obviously, more research is needed to enrich our understanding of social media deployment among local governments. One question that requires further attention asks for the effects of social media deployment: Are municipalities that are present on social media (and make active use of this instrument) more successful – economically or politically? Empirical studies on this question must control for the selection into treatment and thus build on profound knowledge about the factors that drive social media deployment. The current study adds to this knowledge.

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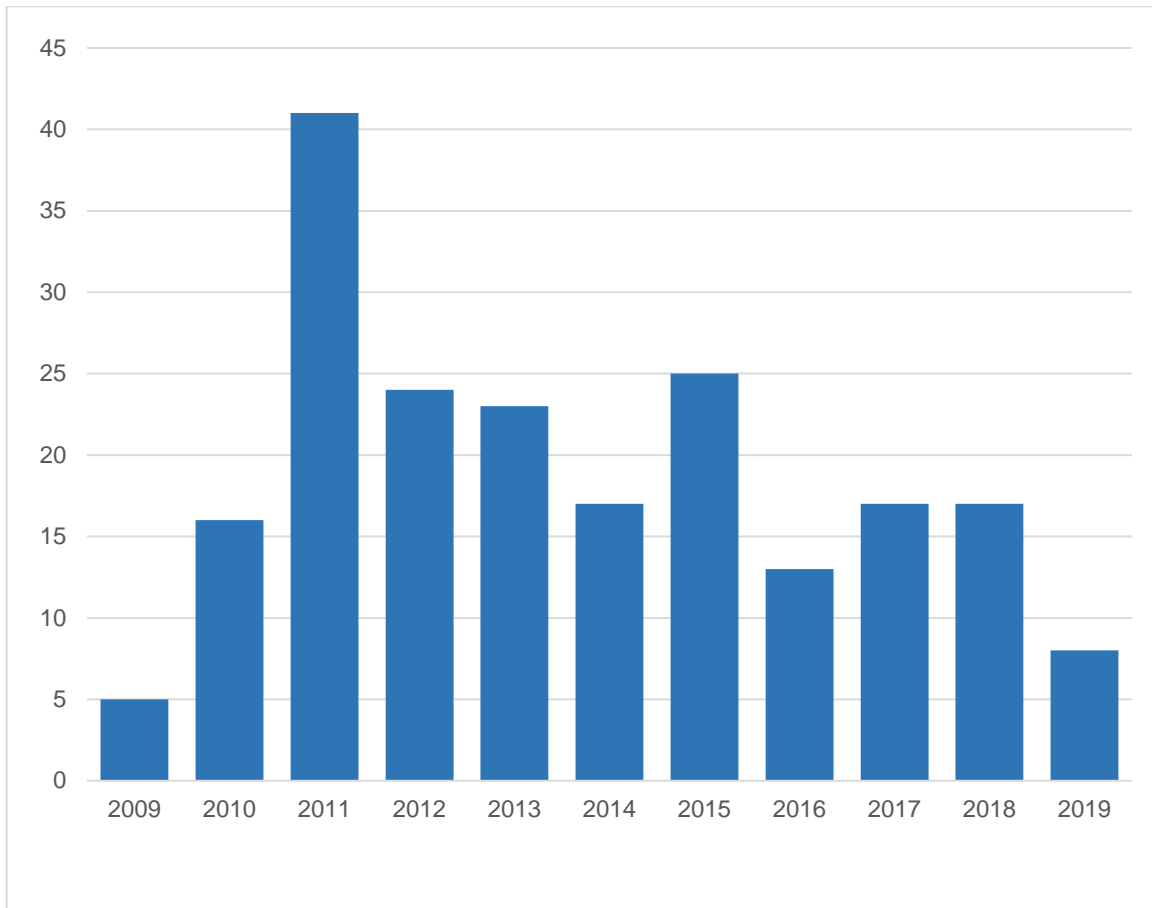
Figures and tables**Figure 1: Number of Hessian municipalities launching a Facebook page from 2009 to 2019**

Figure 2: Hessian municipalities with official Facebook page in 2018

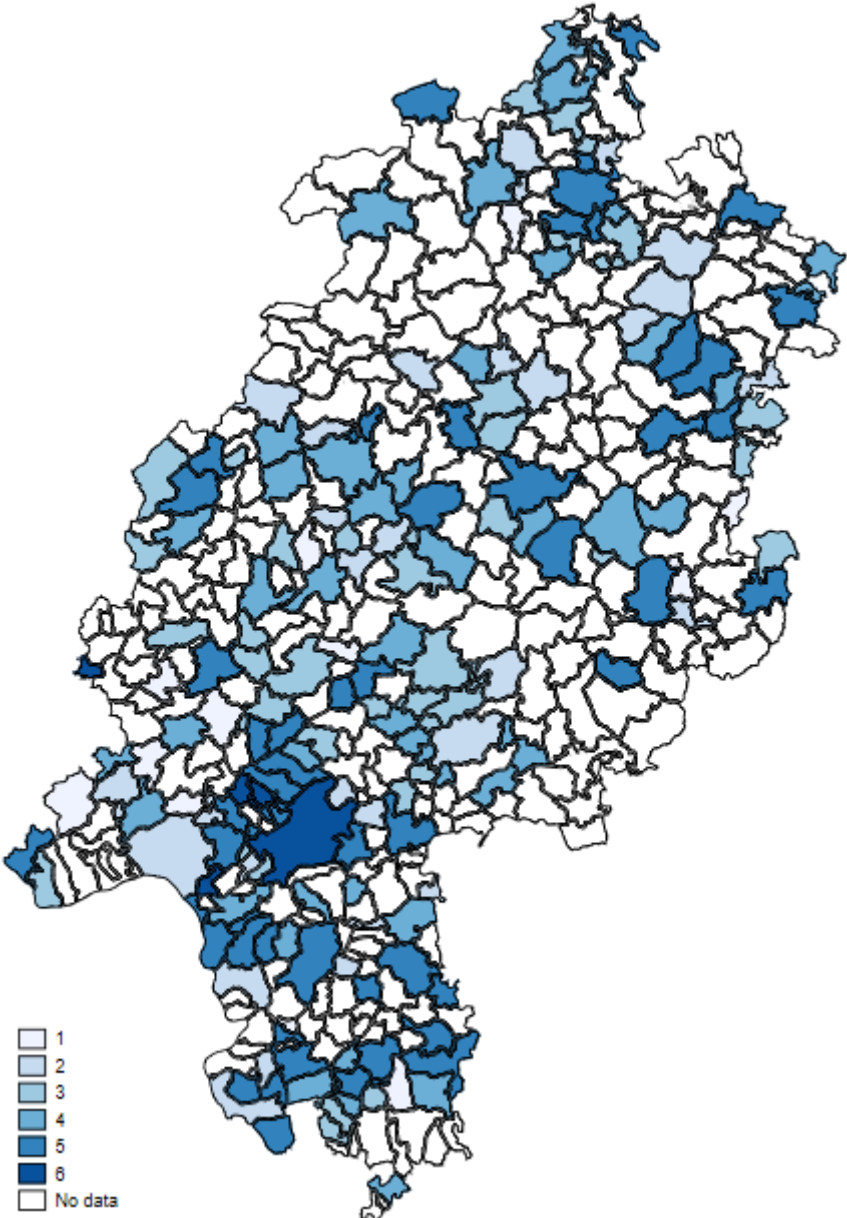


Table 1: Descriptive statistics for the year 2010; differentiating between municipalities with and without an official Facebook page

Variable	Municipalities with a Facebook page by 2019					Municipalities without a Facebook page by 2019				
	Obs	Mean	Std.Dev.	Min	Max	Obs	Mean	Std.Dev.	Min	Max
Land tax rate	206	278.51	46.173	140	490	215	266.721	33.997	200	400
Business tax rate	206	336.243	32.742	270	460	215	325.172	26.543	250	380
Sum of land & business tax rates	206	614.752	71.185	420	930	215	591.893	48.873	450	720
Ratio of land to business tax rate	206	.828	.109	.5	1.186	215	.823	.108	.632	1.25
Median business tax rate	205	330.759	22.114	295	400	213	327.678	21.852	285	380
Median land tax rate	205	272.354	28.326	217.5	350	213	269.225	26.469	220	350
Sum median land & business	205	603.112	43.031	530	735	213	596.904	41.288	530	705
Median ratio of land to business tax	205	.825	.081	.68	1.186	213	.823	.076	.671	1.186
Rate of Population fluctuation	206	10.884	2.537	3.573	24.59	215	10.416	2.654	5.313	28.257
Net rate of emigration [%]	206	.026	.717	-1.992	2.698	215	.135	.723	-3.486	2.25
Neighbors on Facebook [%]	203	8.398	17.421	0	100	213	2.724	8.002	0	60
Revenue from tax sharing pc (abs.)	206	437.126	102.020	234.777	808.506	215	405.252	86.381	260.928	724.931
Realsteueraufbringungskraft	206	466.127	538.785	92.040	6084.467	215	400.293	406.338	98.665	3844.938
Population size (abs.)	206	20,722	54,133	1,105	680,000	215	8,263	6,492	1,090	43,283
Population density	206	1.077	9.397	.046	135.127	214	6.609	52.449	.04	566.429
Population share under 18 [%]	206	22.483	1.489	17.407	26.445	215	22.384	1.805	15.779	28.163
Population share 18-24 [%]	206	7.685	1.015	4.999	14.657	215	7.76	.789	4.982	10.718
Population share over 64 [%]	206	.21	.025	.151	.302	215	.208	.025	.159	.318
Runoff election	206	.223	.417	0	1	216	.167	.374	0	1
Voter turnout (city council)	206	49.954	7.233	31.046	72.305	215	52.259	7.622	36.114	78.568
Tourist guide stars	206	.073	.26	0	1	215	0	0	0	0
Broadband wired internet [%]	206	33.095	37.102	0	98.3	215	16.67	29.372	0	97.6
Local (major) parties on Facebook	206	.131	.338	0	1	216	.037	.189	0	1
Mayor's tenure	206	5.456	2.892	0	10	215	5.726	3.085	0	10
Mayor's age	201	51.652	7.527	31	66	202	50.891	8.022	30	72
Female mayor	206	.083	.276	0	1	215	.056	.23	0	1

Table 2: Regression results from the hazard model on joining Facebook (odds ratios)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Business tax rate	1.004 (0.00278)				1.002 (0.00303)		1.003 (0.00291)	
Land tax rate	1.010*** (0.00129)				1.009*** (0.00129)		1.011*** (0.00143)	
Sum of land & business tax rates		1.008*** (0.00147)				1.006*** (0.00156)		1.007*** (0.00160)
Ratio of land to business tax rate ratio		1.852 (1.132)				2.253 (1.433)		3.035* (1.901)
Median business tax rate (m & neighbors)			1.007* (0.00406)					
Median land tax rate (m & neighbors)			1.013*** (0.00184)					
Sum median land & business (m & neighbors)				1.010*** (0.00192)				
Ratio of median land to business tax (m & neighbors)				2.025 (1.959)				
Rate of net emigration [%]	0.985 (0.0813)	0.981 (0.0808)	1.041 (0.0970)	1.035 (0.0950)	0.989 (0.0788)	0.987 (0.0790)	0.968 (0.0820)	0.965 (0.0814)
Rate of population fluctuation	1.081*** (0.0295)	1.081*** (0.0295)	1.071* (0.0374)	1.071** (0.0369)	1.087*** (0.0325)	1.085*** (0.0323)	1.067*** (0.0225)	1.067*** (0.0228)
Pre-election year (t-1)	1.624** (0.375)	1.624** (0.374)	1.566* (0.359)	1.571** (0.360)	1.631** (0.407)	1.637** (0.408)	1.781** (0.419)	1.785** (0.418)
Pre-election year (t-2)	1.296 (0.326)	1.284 (0.323)	1.308 (0.321)	1.310 (0.321)	1.311 (0.324)	1.298 (0.321)	1.198 (0.311)	1.188 (0.309)
Neighbors on Facebook [%]	1.031*** (0.00530)	1.032*** (0.00529)	1.028*** (0.00599)	1.028*** (0.00599)	1.026*** (0.00489)	1.026*** (0.00484)	1.031*** (0.00545)	1.032*** (0.00544)
Revenue from tax sharing per capita (log)	0.311*** (0.109)	0.291*** (0.101)	0.275*** (0.104)	0.252*** (0.0910)	0.343*** (0.139)	0.306*** (0.121)	0.343*** (0.127)	0.312*** (0.115)
Realsteueraufbringungskraft per capita (log)	2.434*** (0.414)	2.363*** (0.400)	2.106*** (0.377)	2.093*** (0.375)	2.425*** (0.429)	2.335*** (0.410)	2.574*** (0.448)	2.511*** (0.435)
Population size (log)	0.534*** (0.114)	0.523*** (0.109)	0.562*** (0.120)	0.557*** (0.119)	0.452*** (0.103)	0.438*** (0.0968)	0.488*** (0.109)	0.480*** (0.105)

Population density	0.992*** (0.00252)	0.992*** (0.00253)	0.998 (0.00246)	0.997 (0.00243)	0.995** (0.00260)	0.995** (0.00262)	0.993*** (0.00258)	0.993*** (0.00258)
Population share under 18 [%]	0.793*** (0.0559)	0.793*** (0.0565)	0.763*** (0.0569)	0.761*** (0.0576)	0.804*** (0.0625)	0.808*** (0.0630)	0.775*** (0.0584)	0.774*** (0.0590)
Population share 18-24 [%]	0.911 (0.0633)	0.903 (0.0650)	1.003 (0.0692)	0.998 (0.0699)	0.918 (0.0663)	0.911 (0.0670)	0.930 (0.0652)	0.918 (0.0665)
Population share over 64 [%]	0.866*** (0.0308)	0.861*** (0.0305)	0.867*** (0.0308)	0.861*** (0.0304)	0.891*** (0.0384)	0.890*** (0.0386)	0.863*** (0.0314)	0.856*** (0.0311)
Runoff election	1.192 (0.242)	1.210 (0.244)	1.436* (0.304)	1.430* (0.304)	1.219 (0.245)	1.245 (0.248)	1.204 (0.259)	1.218 (0.261)
Voter turnout [%]	1.005 (0.0133)	1.005 (0.0135)	0.993 (0.0152)	0.993 (0.0153)	1.001 (0.0140)	0.999 (0.0141)	1.005 (0.0136)	1.004 (0.0137)
Tourist guide stars	0.549** (0.147)	0.549** (0.150)	0.943 (0.269)	0.956 (0.269)	0.599* (0.171)	0.594* (0.174)	0.574** (0.142)	0.577** (0.144)
Broadband wired internet [%]	1.007** (0.00308)	1.007** (0.00310)	1.008*** (0.00294)	1.008*** (0.00296)	1.008** (0.00308)	1.008** (0.00309)	1.008** (0.00306)	1.008** (0.00308)
Local (major) parties by Facebook					3.277*** (0.625)	3.227*** (0.612)		
Share of academics [%]					0.441 (1.005)	0.825 (1.847)		
Mayor's tenure	1.050 (0.0315)	1.050 (0.0316)	1.055* (0.0324)	1.054* (0.0325)	1.047 (0.0312)	1.049 (0.0312)	1.041 (0.0310)	1.042 (0.0312)
Mayor's age	0.973*** (0.00959)	0.972*** (0.00959)	0.966*** (0.00982)	0.966*** (0.00991)	0.983* (0.0102)	0.982* (0.0101)	0.975** (0.0110)	0.975** (0.0110)
Female mayor	0.638 (0.267)	0.660 (0.272)	0.736 (0.272)	0.754 (0.276)	0.590 (0.236)	0.604 (0.237)	0.741 (0.336)	0.770 (0.343)
yearwise baseline hazard rates included	yes	yes	yes	yes	yes	yes	yes	yes
mayors' party affiliation & council seat shares included	yes	yes	yes	yes	yes	yes	yes	yes
χ^2 -statistics	1456.79***	1573.52***	1342.01***	1358.45***	1571.03***	1682.09***	1166.87***	1257.05***
Observations	2,759	2,759	2,759	2,759	2,756	2,756	2,569	2,569

Appendix

Table A.1: Variable description

Variable	Measure
Land tax rate	Municipal land tax B rate multiplier w.r.t. developed real estate and build-able ground
Business tax rate	Municipal business tax rate multiplier
Sum of land & business tax rates	The sum of the land tax B and business tax multipliers
Ratio of land to business tax rate ratio	The land tax B multiplier to business tax multiplier ratio
Median land tax rate (m & neighbors)	The median land tax B multiplier among neighboring municipalities
Median business tax rate (m & neighbors)	The median business tax multiplier among neighboring municipalities
Sum median land & business (m & neighbors)	The sum of the median land tax B and median business tax multipliers among neighboring municipalities
Ratio of median land to business tax (m & neighbors)	Ratio of median land tax multiplier to business tax multiplier among neighboring municipalities
Rate of population fluctuation	Sum of emigrants +immigrants divided by total population
Rate of net emigration [%]	Net migration rate, (emigrants –immigrants)/population
Pre-election year (t-1/2)	Dummy = 1 marking year 1/2 years prior to the election
Neighbors on Facebook [%]	share of neighboring municipalities that have an official Facebook page, in percent
Revenue from tax sharing per capita (log)	Natural log of tax revenue from tax-sharing (income- and value-added taxes) per capita
Realsteueraufbringungskraft per capita (log)	Sum of fictitious tax revenues (the tax base for land and business taxes multiplied with the average tax rate in the relevant year)/population.
Population size (log)	Natural log of the total number of citizens
Population share under 18 [%]	Share of population under the age of 18 years old
Population share 18-24 [%]	Share of population between 18 and 24 years of age
Population share over 64 [%]	Share of population older than 64 years of age
Population density	Population density
Voter turnout [%]	Voter turnout at the elections for the city council
Tourist guide stars	Dummy=1 if municipality m contains a touristic site marked with a star in one of the leading German tourist guides
Broadband wired internet [%]	Percentage of households within municipality m that have access to a 50 Mbit wired internet connection
Runoff election	Dummy=1 if the mayor was elected in a runoff election.
Share of academics [%]	Share of academics in municipality m
Local (major) parties on Facebook	Dummy = 1 if one of the major political parties have a local Facebook page
Mayor's tenure	Tenure in office of the elected mayor, during the observation period
Mayor's age	Mayor's age
Female mayor	Dummy = 1 if mayor is female