The Economic Effects of Regional Identity: Evidence from German License Plates*

Thilo R. Huning†
University of York

Fabian Wahl‡
Vienna University of Economics and Business

—EARLY DRAFT, DO NOT QUOTE WITHOUT PERMISSION—

Abstract

In this paper, we show that regional identity, the degree to which people feel a belonging in a specific place, is relevant for economic decisions. Our quantification exercise relies on the recent liberalization of vehicle license plates in Germany. This allows us to create a novel and clean measure of regional identity. We argue theoretically and provide empirical evidence for the idea that individuals consider their regional identity when making economic decisions, such as choosing to commute less to other regions, investing more in start-ups from the same area, and being more inclined to vote for parties that highlight identity over redistribution.

Keywords: regional identity, rootedness, commuting, voting behavior, local bias, venture capital investments

JEL Classification: D72, G41, J61, R23, Z19

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†Thilo is a senior lecturer at the Department for Economics and Related Studies, University of York, Heslington, York YO10 5DD, UK; e-mail: thilo.huning at york.ac.uk.

‡Fabian is an assistant professor at Department of Socioeconomics at the Vienna University of Economics and Business, Institute of Economic and Social History, Welthandelsplatz 1, 1020 Vienna, Austria and an affiliate of the CEPR, London EC1V 0DX, UK; e-mail: fabian.wahl at wu.ac.at.

"Every human being needs to have multiple roots and to derive almost all of their moral, intellectual and spiritual life from the environment to which they naturally belong."
Simone Weil (1909–43)

1 Introduction

How does the place you come from affect your economic decisions? How does it determine where you commute to, who you trust your money with, and how you vote? Social scientists find increasing evidence for the role of an intangible aspect of culture: identity. Common identities stemming from feeling attached to the same place can ease cooperation with people who share this identity, and complicate cooperation with others.[1] Anyone has a multitude of characteristics that make them feel more or less similar to somebody else, including race, class, religion, gender, or the place they are from. People identify with places they feel rooted in. These could be large places such as their continent, supranational entities such as the EU, their nation, region, or city, and smaller places such as their neighborhood. This is because humans assume that other people from the same place are more similar to them than others.[2] For some people, these real and imagined similarities are an important driver of their economic decisions. Strong roots anchor these people to their place and makes it harder for them to work in other locations, less likely to trust people from other places with money, and more likely to vote for parties that cater to their need for rootedness and regional identity. Regional identity, as we show, is an important yet unexplored aspect of the spatial structure of our economy.

To test this idea, we first present a novel (and clean) way to quantify identification with the region. In a second step, we then show that variation in our measure of regional identity is relevant for commuting behavior, investment in start-ups, and also voting.

A clean measure of regional identity on these regions has not yet been produced by the literature. Most of the existing data available across regions is based on surveys. These surveys suffer from ample epistemological problems like social-desirability bias or demand characteristic bias, and the fact that respondents do not face any economic consequences from the nature of their response. A perfect measure of the degree of regional

[1] The field of identity economics was founded by Akerlof and Kranton (2010).

[2] A central contribution for the constructed nature of national identity is Anderson (1983). See Section 2 for an overview of this literature. Important contributions include Coval and Moskowitz (1999) and Cumming and Dai (2010), and more recently Dehdari and Gehring (2022).

identity is related to decisions that are observed by others but otherwise have no direct consequences. Ideally, individuals can reveal themselves as more or less attached to a smaller regional entity and face the economic consequences of this decision because other individuals sympathize (or openly share) their choice, or object to it. We think that the 2012 license plate liberalization in Germany provides us with a clean measure of regional identity.

Note: The Unterscheidungskennzeichen (UZ) is the first part of any private license plate in Germany and identifies the region that the vehicle is registered in. This example plate is from a place called Wattenscheid, abbreviated WAT.

Figure 1: German license plates reflect regional identity

Figure 1 shows that private license plates in Germany start with an abbreviation for a region, called *UZ*. We chose a plate from Wattenscheid (abbreviated WAT) as our example because it was prominently portrayed as a region (here: a city) in which car owners used to have, then lost, and then regained the ability to express their belonging to their place—Wattenscheid—through their cars' license plates.[3] Wattenscheid was an independent city and center of coal mining, and WAT plates were a common sight in West Germany since the 1950s. WAT plates were no longer handed out after 1975, when Wattenscheid became a part of Bochum (an arch rival in many dimensions, including public infrastructure, finances, not to forget Bundesliga football). Hence, plates for new cars registered in Wattenscheid after 1975 started with BO. The decline of the coal industry, the closure of the last mine in 1973, and the incorporation into Bochum form the base of a narrative of decline, technocracy, and hostile takeover that is still salient among inhabitants. This contributed to the reintroduction of WAT license plates in 2012.

All this is because the German car registration is organized at the county level since 1956, and between then and 2012 the UZ on a license plate was simply the abbreviation of the county it was registered in. Especially in the 1970s, regional reforms, such as the merger of Wattenscheid with Bochum, all with the intention of cutting administrative costs, merged, rearranged, and erased existing counties (see Blesse and Roesel 2019). This made well-

[3]Examples for this national coverage include https://www1.wdr.de/radio/wdr4/programm/themenwoche-neue-alte-autokennzeichen-100.html (Accessed 28/08/2025) and https://www.zeit.de/gesellschaft/zeitgeschehen/2012-08/Autokennzeichen-Ramsauer-Glosse (Accessed 28/08/2025).

known abbreviations on license plates disappear, a process that was perceived as a loss for many car owners who felt that "their" UZ was taken from them. They perceived this loss even more significant when the UZ that replaced the old ones reiterated long-curated local rivalries. These feelings became a grassroots movement and finally a 2012 law that has since allowed counties to reintroduce UZs, and present car owners with the choice between the UZ of the modern county and one (or several) UZs of counties that no longer exist as administrative units. A total of 170 counties have since reintroduced UZs.[4] Car owners who chose a re-introduced UZ face a small fee, the same fee that applies to any desired (instead of a random) license plate ("Wunschkennzeichen").

The significance of license plates as a measure of regional identity is clear for the economist's eye: Much like special credit cards in Bursztyn et al. (2018), these desired license plates differ from regular license plates in only one dimension: They tell everyone else something about the owner. Unlike a platinum credit card, having a reintroduced license plate UZ does not show off the car owner's wealth;[5] it's telling the world that the owner was willing to pay extra to showcase their regional identity.

In a survey of 50,000 people by Bochert (2014), the majority of the participants responded that reintroduced UZs are an important part of their identity and 76 percent were in favor of reintroduction.[6] As such, the reintroduced license plates gave car owners the opportunity to signal allegiance to a smaller region. Hence, we interpret a higher share of these plates in a county as a measure of a stronger regional identity.

To show that regional identity shapes the economy, we use three well-established decisions: whether to commute and where to, where to invest, and who to vote. Specifically, we study how regional identity relates to (i) out-commuting flows, (ii) the local bias of venture capital (VC) investors, and (iii) voting outcomes. For commuting and investment decisions, we employ gravity-like regression models using large datasets of municipality and county pairs. For voting behavior, we analyze support for left- and right-wing parties in German federal elections from 1980 to 2025. Our results show that regional identity has a significant immobilizing effect: individuals in areas with stronger regional identity

[4] A total of 355 UZs ceased to exist with their respective German counties.

[5] Empirically, we rule this out in our robustness section.

[6] This has also been noted by Germany's largest automobile association, the ADAC ("Allgemeiner Deutscher Automobil Club"). They also argue that license plates are a way to express identification with one's home region (ADAC Executive Committee 2018).

are less likely to commute to other municipalities. We also find that VC investors exhibit greater local bias in such regions, allocating disproportionate capital to nearby start-ups. Finally, consistent with existing research on voting behavior, we document that municipalities with stronger regional identity are significantly more likely to support right-wing and far-right parties.

The remainder of the paper is organized as follows: Section 2 provides a comprehensive review of the relevant literature. We present the data in section 3. Section 4 explains how this regional identity is relevant for economic decisions. Section 5 concludes.

2 Related Literature

On the most general level, this paper contributes to a literature on history on the spatial structure of the economy in general (Davis and Weinstein (2002), more recently Dincecco and Gaetano Onorato (2016) and Heblich, Trew, and Zylberberg (2021)), specifically in Germany (Wolf 2009; Voigtländer and Voth 2012; Lameli et al. 2015; Ahlfeldt et al. 2015; Buggle 2016; Huning and Wahl 2021). Our assumption (which we explore systematically in Huning and Wahl (2025)) is that people from some regions have historically developed a strong group identity and feeling of belonging to this region, while other regions did not.

A large literature dating back to Akerlof and Kranton (2010) has developed a theoretical framework that links individuals' behavior to their feeling of belonging to groups, from there conceptualizing how this affects cooperative decisions. They termed the concept of 'groupiness' as the degree to which an individual prefers members of their own group over nonmembers. Since investment decisions are cooperative decisions, this framework applies to our context.

The argument that geographic regions—even regions as large as nations—produce a sense of shared characteristics among their inhabitants (which may be both imagined or constructed and real) goes back to Anderson (1983) that form the people from a region into such a a group. It is important to note that the formation of one's identity shares commonalities with cultural transmission in general (Bisin and Verdier 2000), while an individual's regional identity may, on the other hand, also change according to life circumstances, such

as migration.[7] Recent social psychological literature (Obschonka et al. 2025; Plaut et al. 2012; Rentfrow, Gosling, and Potter 2008; Rentfrow, Jokela, and Lamb 2015) has shown that psychological characteristics are clustered in space, suggesting a link between shared characteristics and regional identity. The reason for this clustering is seen predominantly in intergenerational (vertical) transmission (see Bisin and Verdier 2000; Tabellini 2008; Guiso, Sapienza, and Zingales 2016). Rustagi and Veronesi (2016) find that parents and grandparents transmit their sense of the region to which they belong. Migration is not found to dramatically affect this sense. First, this is because a strong sense of regional identity reduces emigration from these regions, as outlined in Kremer (2021). Second, Rentfrow, Gosling, and Potter (2008) show that if someone from a region with a strong identity migrates to another region, this second region is more likely to also have a strong regional identity because a strong regional identity is a characteristic itself, and an individual self-selects into this shared characteristic. It is also known that people who live closer to each other tend to be more similar and that there is a tendency for people to 'fit in', which means they behave and think like people they regularly interact with. The literature suggests that people who migrate from a place with a weak regional identity to a place with a strong regional identity become part of local rituals and strengthen the regional identity of their chosen home in time (for example, participating in local festivals and traditions).[8]

3 Data

3.1 Data on German License Plates

Data on car license plates. We purchased municipal-level data on vehicle distribution from the Federal Motor Transport Authority (*Kraftfahrtbundesamt*). These data provide us with the number of vehicles registered in a municipality per UZ on the license plate, and represent the situation as of 01.01.2019, seven years after the reform.[9] Here, we are interested in data on UZs that were reintroduced after the liberalization of the license

[7] We are thankful to Gérard Roland for encouraging us to distinguish the two concepts, culture and identity, more clearly.

[8] As shown by Rios and Moreno-Jimenez (2012). Those who migrate from a place with a weak regional identity to a place with a strong regional identity will form strong feelings of attachment to this region. Their study compares natives and migrants in Málaga (Spain) and finds that immigrants reach the same level of regional identity as natives after some years.

[9] The term UZ is explained on page 3.

plates in 2012. At that time, 170 counties had decided to reintroduce a total of 355 UZs. These counties consist of 6,059 municipalities, and the share of cars with reintroduced UZs on their license plates was on average 19.41 percent. A list of these reintroduced UZs can be found in the Online Appendix, Table A.1. Since our empirical analysis relies on outcomes averaged over longer time periods, we calculate the share of vehicles with reintroduced UZs at the municipal level as of 2010.

Information on UZs is taken from an official list from the German vehicle registration office (Kraftfahrt-Bundesamt 2018), augmented with information on reintroduced UZs from Wikipedia.[10] We use these data to calculate the share of vehicles with license plates of reintroduced UZs as a measure of regional identity. Figure 3 shows this share of reintroduced license plates per municipality. The darker the municipality is shaded, the higher the share of vehicles with re-introduced UZs on their license plate. The borders represent contemporary counties.[11]

Validation of our regional identity measure. To validate license plates of reintroduced UZs as a measure of regional identity, we test whether this is significantly positively related to alternative measures of regional identity coming from survey questions asking people to what degree they feel attached to a particular spatial unit like a region or a country. We compare our license plate measure with the two surveys.

These surveys are the European Values Survey (EVS) and the European Quality of Government (EQI) survey of the World Government Institute. By comparing the share of license plates from reintroduced UZs with the more standard survey questions on spatial identities on the NUTS-2 level, we find a significant and positive correlation between these surveys and our measure based on license plates. For example, the correlation between the EVS survey question and our license plate-based measure is 0.29 (significant at the 10 percent level), and between our measure and the regional identity measure of the EQI it is even higher, 0.35 (significant at the 5 percent level).[12] Remarkably, this is *higher* than the correlation between the EVS and the EQI survey question on regional identity (identification with place of residence), which is 0.23.

[10] https://de.wikipedia.org/wiki/Kennzeichenliberalisierung (Last accessed on 15th July, 2022).

[11] The county is the level that decides over the re-introduction of UZs.

[12] We refer the reader to the Online Appendix section A.2 for a detailed explanation of how we have constructed the EVS survey question on regional identity. There, we also provide maps showing the spatial distribution of regional identity in German NUTS-2 regions according to both the EVS and the EQI survey.

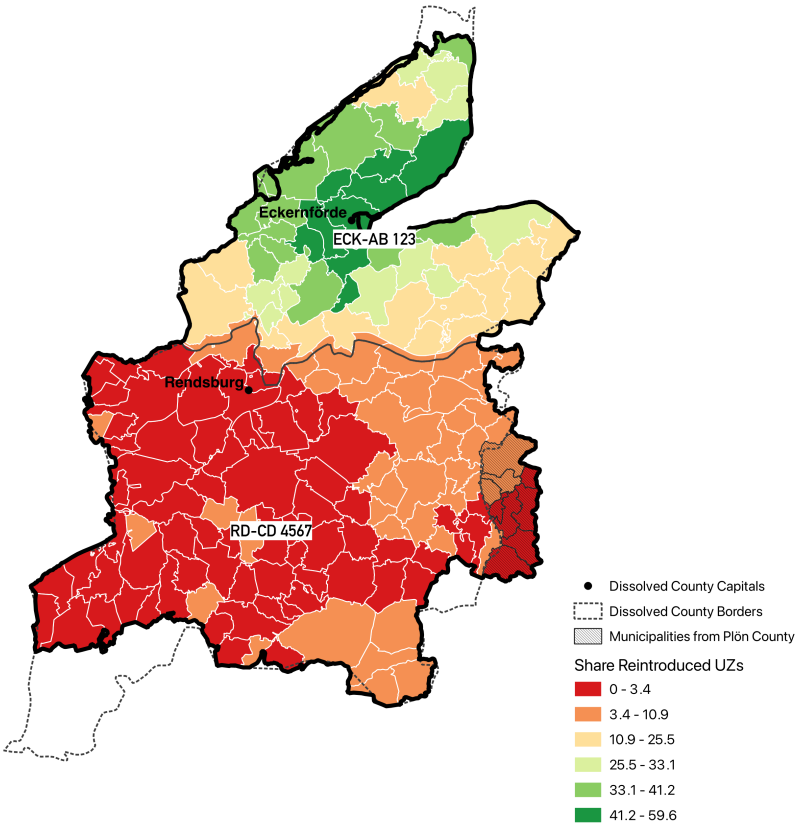
We take this as suggestive evidence for the validity of our measure, especially since it appears to be more strongly related to the survey questions than the survey questions are correlated with each other. In the Appendix, we also show that our measure is highly significantly correlated (correlation coefficient is 0.85) with an alternative measure of regional identity that is also based on revealed preferences: the share of street names with regional references in 12 municipalities in Baden-Württemberg (see section A.3). Finally, in Appendix section A.3.2, we demonstrate that our measure does not reflect regional differences in Big Five personality traits or geographical and historical factors (e.g., elevation, location on a major river, being part of Roman Germany, or exposure to the plague).

Our Measure Exemplified. Consider Figure 2. It shows the county of Rendsburg-Eckernförde, situated in the state of Schleswig-Holstein, on the coast of the Baltic Sea. Rendsburg-Eckernförde was created in 1970 as part of the county reform in Schleswig-Holstein, as a union of the county of Rendsburg, the county of Eckernförde, and nine municipalities from the neighboring county of Plön.[13]

This administrative reform had consequences for the car license plates: Rendsburg, the largest city in the new county became the seat of the county, which adopted the UZ of the previous county of Rendsburg: `RD`. The UZ of the county of Eckernförde (`ECK`) was discontinued. Consequently, in the eyes of many citizens, the county of Eckernförde became a county dominated by another. The story of Rendsburg-Eckernförde is one of many county mergers conducted in West Germany in the 1970s. This procedure has left behind two categories of citizens: The first category is comprised of those that live in the area which absorbed the other counties and kept their UZ, thus assuming a dominant position within the county. The second category is comprised of citizens with living memory of counties that have been dissolved, and have lost their UZ. The latter group lobbied for the license plate liberalization of 2012—for Rendsburg-Eckernförde, this meant that `ECK` was reintroduced. After this decision, any car owner in the entire Rendsburg-Eckernförde county was able to choose between `RD` and `ECK`. In theory, an individual residing in the territory that formerly comprised the county Eckernförde may opt for the license plate designation `ECK`. Also, an individual who resides in the territory that formerly comprised

[13] In the course of the reform, 17 municipalities from the south of the county of Rendsburg were transferred to the county of Steinburg, the municipality of Einfeld became part of the city of Neumünster, and the municipality of Russee became part of the city of Kiel. The county of Eckernförde gave the municipalities of Kopperby and Olpenitz to the county of Schlwesig-Flensburg.

the county of Rendsburg can select the license plate designation ECK.[14] But as Figure 2 clearly shows, what happened in practice was that car owners from the former county of Eckernförde took the chance to express their identity on their license plate. When they registered a car, they decided against the default option, RD, and paid an extra fee of ten Euros for an ECK plate.

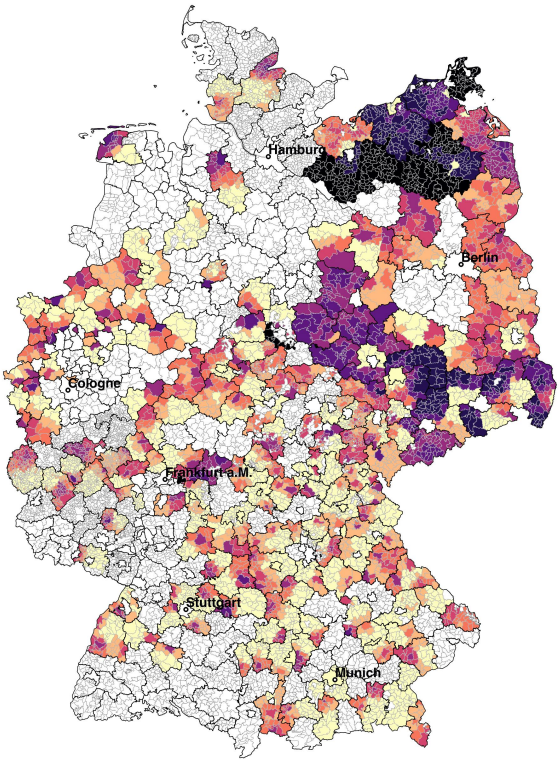


Note: The figure shows the Rendsburg-Eckernförde county in Schleswig-Holstein. The borders of the municipalities in the county are shown in white, the borders of the former counties are indicated by the dashed dark gray lines alongside the locations of the previous county seats (which are also identical to the name of the former county). The darker green a municipality is shaded the higher is its share of reintroduced license plates from the former counties, the darker red it is colored the lower is the share. The figure also shows two exemplary license plates that people could have chosen before the county reform in 1970, and after the liberalizitation: ECK-AB 123 and RD-CD 4567.

Figure 2: Share of Reintroduced UZs in the Municipalities of the Rendsburg-Eckernförde county and the Borders of the Former Counties

[14]Note that the UZ of the former county of Plön to which nine of the municipalities of the current county used to previously belonged, is not yet reintroduced—-the UZ PLÖ cannot be chosen here.

Consequently, the measure of regional identity employed is the proportion of reintroduced license plates from all reintroduced UZs of former, dominated counties in the current county Rendsburg-Eckernförde. In other words, for each municipality in the county of Rendsburg-Eckernförde, we calculate the share of cars with the UZ ECK. We consider it to be a valuable signal of identity not only if one chooses to have ECK if one lives in the former county of Eckernförde, but also if one lives in the former county of Rendsburg or Plön.



Note: The figure shows the share of vehicles with re-introduced UZ in each municipality. The darker a municipality is shaded the higher is its share. The bold black borders are those of contemporary counties. The gray borders indicate municipalities without vehicles with re-introduced UZs.

Figure 3: Share of Vehicles with Re-introduced UZs in German Municipalities

The rationale behind this is that it is probable that if car owners choose ECK despite not residing in the former county of Eckernförde, they do so because they identify with it more than with their current place of residence. This may be due to their upbringing, em-

ployment, or educational history in the area. However, we do *not* consider reintroduced UZs from former counties elsewhere in Germany. We also do not count reintroduced license plates in counties which did not reintroduce any dissolved UZs, like all the big cities.[15]

We show, relying on a spatial RDD for the whole of Germany, that Rendsburg-Eckernförde is not an outlier: the share of reintroduced UZs within a given contemporary county is significantly higher in dominated former counties than it is in the dominating former counties (for which the UZ did not change). Results are shown in the Online Appendix, Table A.2.

3.2 Commuting Data

The Federal Employment Agency (Bundesagentur für Arbeit) provides municipality-level data on commuting flows—both inbound and outbound—which can be accessed online.[16] For the purposes of this study, we focus on out-commuting. The data report, for each municipality, the number of individuals who commute from any municipality to any other municipality over the course of a year. Out-commuters are defined as individuals who reside in a municipality but work elsewhere. We use data for the most recent year available, 2024. To prepare the dataset for empirical analysis, we construct a full set of municipality pairs. Since there are no commuting flows between most municipality pairs, these data are zero-inflated, a fact we need to respect when estimating. As additional covariates, we include the 2019 residential population from the German Local Population Database (GPOP) by Roesel (2023). Crosswise distances between all municipalities in the data set (in kilometers) are calculated using a GIS-based algorithm. We further include the average luminosity level of the place of residence in 2021 as a proxy for economic development. The luminosity data is taken from version 2.1 of the annual VIIRS Nighttime Lights data set provided by the Earth Observation Group at the Colorado School of Mines (Elvidge et al. 2021).

[15] For example, if an individual relocates from a rural area in which they were raised to Berlin and retains the reintroduced UZ until they purchase a new vehicle (at which point they are required to take the UZ B for Berlin), this is not considered.

[16] https://statistik.arbeitsagentur.de/DE/Navigation/Statistiken/Interaktive-Statistiken/Pendler/Pendler-Nav.html

3.3 Investment Data

Date on Investments of Venture Capitalists. We have retrieved transaction data on venture capital investments from German venture capitalists into German Start-Ups for the time period from 2.11.1999 to 5.8.2019 from Thomson Reuters' EIKON database. Augmenting these data with information on the location of the headquarters of venture capitalists and start-ups leads to a data set of 478 German venture capitalists (VCs) located in 114 locations and 2,834 start-ups located in 542 different German municipalities. We geocoded the headquarters to calculate the distance using gpsvisualizer.com.

Data on the distribution areas of regional newspapers. To proxy information flows, we digitized the distribution areas of regional newspapers in Germany in 2022. This information comes from a map contained in the "Zeitungsatlas" (atlas of newspapers) edited by the Zeitungsmarktforschung Gesellschaft der deutschen Zeitungen (ZMG).[17] The distribution areas are visualized in Figure A.9 in the Online Appendix.

Further Control Variables. The characteristics of contemporary counties averaged over the year 2002–2014 are taken from Asatryan, Havlik, and Streif (2017). Here, we consider the population and the share of industry buildings[18]. We aggregate the municipality level data to the county level by taking either summing them up (in case of population) or by calculating county-level averages of the municipality-level variables (in case of the share of industry buildings). We also calculate the average elevation of the municipalities of each county based on the Digital Elevation Model (DEM) of the U.S. Geological Survey's Center for Earth Resources Observation and Science (EROS), the GTOPO30 dataset. This has a spatial resolution of 30 arc seconds.

Finally, we consider the scaled version of Facebook's social connectedness index (SCI) as a proxy for the social ties a NUTS-3 region has with others as of August 2020.[19]

[17] https://www.die-zeitungen.de/media/planungsdaten/verbreitungsgebiete-kartographien.html, accessed last on 5th February 2024.

[18] When we use these data, the number of observations decline because Asatryan, Havlik, and Streif (2017) do not have data for the federal state of Schleswig-Holstein, and most of their data are also missing for Hamburg, Berlin, and for some other municipalities and years.

[19] The publicly available version of the SCI can be downloaded for free here: https://data.humdata.org/dataset/social-connectedness-index (last accessed on 24th July 2022).

3.4 Election Data

We focus on data from the federal elections, because these elections take place simultaneously while all other elections have different dates per state. State elections may, or may not, coincide with other elections, especially local or European elections. Given that the Bundestag has authority over most of the tax revenues, there is also a general perception that the federal level can decide to strengthen (or weaken) the relative power of the regions, and set the degree of redistribution. As such, federal elections are likely the cleanest signal for the role of regional identity.

Data on Election Results. Election data for Germany is available from the GERDA (German Election Database, Heddesheimer et al. (2025)). Since we are interested in long-standing cultural differences, we compute the long-run average vote shares of parties in the federal elections between 1980 and 2025.[20]

Control Variables. We employ a host of contemporary and historical control variables. These include a dummy variable equal to one if a municipality was the location of at least one historical war-related battle between 1250 and 1789, as well as an indicator of historical political fragmentation, which is measured by the average number of historical states intersecting the municipality, and historical political instability (in form of the HPI index described above). These data originate from Huning and Wahl (2023). We also include standard geographic control variables: latitude and longitude of a municipality's centroid, and the interaction of latitude and longitude.

Following the literature on voting behavior in Germany, we include several characteristics of contemporary municipalities. We construct a dummy variable for the five largest German cities (Berlin, Hamburg, Munich, Cologne, and Frankfurt am Main), based on the most recent population figures from the GPOP database by Roesel (2023). From the same source, we also derive a dummy for municipalities that experienced population decline in recent decades. Specifically, we compute population growth in municipality i between 1985 (for municipalities in the former GDR) or 1987 (for municipalities in the BRD) and 2019. For western German municipalities, for example, this is calculated as $PopGrowth8719_i = Pop2019_i / Pop1987_i$. We calculate a dummy variable "Population

[20]The dataset we use is called "federal_muni_unharm.csv" and can be downloaded as csv file from here: https://github.com/awiedem/german_election_data/raw/refs/heads/main/data/federal_elections/municipality_level/final/federal_muni_unharm.csv?download=

Loss," equal to one if this ratio is less than one.

Information on uninhabited areas ("gemeindefreie Gebiete") is taken from Asatryan, Havlik, and Streif (2017). A dummy for municipalities in the former GDR is constructed based on their assignment in the GPOP dataset: municipalities located in the federal states of Berlin, Brandenburg, Mecklenburg-Western Pomerania, Saxony, Saxony-Anhalt, and Thuringia are coded as belonging to the former GDR.

We also code a dummy variable for municipalities with an active university in 2019, using data from the Federal Statistical Office. This includes all accredited institutions, including technical universities.[21] The municipal share of Catholics as of 2022 is obtained from the 2022 German Population Census, as provided by the Federal Statistical Office.[22]

Average luminosity in 2019 is again sourced from the VIIRS annual nighttime lights dataset, as previously used in the commuting analysis (Elvidge et al. 2021). Homola, Pereira, and Tavits (2020) argue that the location of labor camps in the Nazi time affects out-group behavior of Germans to the day. To control for this, we compute the distance from each municipality to the nearest Nazi concentration or labor camp (including subcamps, youth camps, etc.) in kilometers, using the "SS Concentration and Labor Camps" dataset assembled by Knowles et al. (2014).[23]

A descriptive overview of all variables and data sets used in the empirical analysis can be found in the Online Data Appendix, Tables A.4, A.5 and A.6.

4 Empirical Approach & Results

4.1 Regional Identity and Commuting

Our empirical investigation into the consequences of regional identity for economic and political outcomes starts with an examination of its relationship with commuting behavior. The underlying hypothesis is that individuals from areas with a strong sense of regional identity are significantly less likely to commute to other municipalities for work.

[21] This includes all certified universities, including technical universities.

[22] The data can be downloaded from https://www.destatis.de/DE/Themen/Gesellschaft-Umwelt/Bevoelkerung/Zensus2022/Publikationen/Downloads-Publikationen/Sonderauswertungen/bevoelkerung_religionszugehoerigkeit_je_gemeinde.html. Accessed August 25, 2025.

[23] The data can be downloaded here: https://holocaustgeographies.org/sites/default/files/2020-09/SSCampDataset.zip. Accessed August 24, 2025.

In traditional models of commuting,[24] workers in their location of residence i trade off the disutility from the commutes to their workplace j with the increased wage they can achieve in another location j. It is well established to express the disutility as a function of both i and j, and rely on gravity frameworks for estimation (see Krebs and Pflüger (2023) for a recent example on Germany). We hypothesize that our regional identity measure explains commuting decisions: The experienced disutility from working in another region is higher for individuals with a higher attachment to their own region. Therefore, the higher the regional identity of a region, the lower the number (and share) of people who commute out of this region.

To test this, we employ a gravity-type model, in which the number of out-commuters from municipality i to municipality j is explained by the distance between i and j, population size, economic development (proxied by night-time luminosity in 2021) at the place of residence, regional identity at the place of residence (measured by the share of vehicles with reintroduced UZs), and workplace fixed effects.

We use official commuting statistics from the Federal Employment Agency for the year 2024, which report the number of out-commuters for each pair of municipalities. These data contain approximately 200,000 municipality pairs with non-zero out-commuting flows, covering 7,989 residential municipalities and 10,439 workplace municipalities. In total, 10,987 unique municipalities are included in the dataset—either as places of residence, work, or both.

For the analysis, we construct a comprehensive dataset of all possible municipality pairs, resulting in $10,987 \times 10,987 = 120,516,484$ observations. We calculate pairwise distances between all municipalities and merge these with the out-commuting data, as well as with luminosity and population data.

To account for the large number of zero commuting flows in the data, we estimate the following gravity-type equation using Poisson Pseudo Maximum Likelihood (PPML). Standard errors are clustered at both the residential and workplace municipality level.

$$Y_{ij} = \alpha + \beta ln(Identity)_i + \gamma ln(D)_{ij} + \delta Pop_i + \eta ln(L)_i + \pi_j + \epsilon_{i,j}, \tag{1}$$

Y_{ij} is the number of out-commuters from municipality i to j in 2024. $ln(Identity)_i$ is the

[24] See Manning (2003) for an overview.

natural logarithm of the share of vehicles with reintroduced UZs on their license plates in a county i, $ln(D)_{ij}$ is the natural logarithm of the straight-line distance between municipality i and j in km, Pop_i is the population of municipality i in 2019, and $ln(L)_i$ is the natural logarithm of the average luminosity in municipality i in 2021. π_j are workplace fixed effects. $\epsilon_{i,j}$ is the error term.

Table 1 presents the results from estimating equation 1. In column (1), we include only the regional identity measure and pairwise distance. Column (2) adds population, and column (3 further includes luminosity as a control. Across all specifications, regional identity displays a statistically and economically significant negative effect on commuting flows. Specifically, column (3) suggests that, on average, a one percent increase in the share of vehicles with reintroduced UZs is associated with a 15 percent reduction in the number of commuters. Considering the high number of zeros in the data and a mean of the dependent variable of only 0.15, this represents a sizable effect.

Results are robust when restricting the sample to municipalities located in counties with reintroduced UZs: the coefficient remains negative and significant (–0.104, p-value = 0.007). These findings suggest that strong regional identity acts as a friction in labor market integration. It seems to discourage individuals from commuting to other places.

Table 1: Explaining out-commuting with regional identity with a Gravity-type model

Dep. Var.	No. of Out-Commuters		
	(1)	(2)	(3)
ln(Percent Vehicles with Reintroduced UZs)	-0.3802***	-0.2466***	-0.146***
	(0.044)	(0.033)	(0.032)
Place of Work FEs	✓	✓	✓
Place of Residence Population 2019	–	✓	–
Place of Residence ln(Luminosity 2021)	–	–	✓
ln(Distance to Place of Work)	✓	✓	✓
Pseudo R^2	0.698	0.761	0.832
Obs.	113,679,720	114,128,096	114,128,096

Notes. Standard errors clustered on the level of both work and living place are in parentheses. Coefficient is statistically different from zero at the ***1 %, **5 percent, and *10 percent level. The units of observation are German municipality pairs. All regressions include a constant not reported.

4.2 Regional Identity and Investment Decisions

In this section, we test whether regional identity has an effect on investment decisions. This is motivated by two strands of the literature. First, the well-known literature about the home, or local bias among investors.[25] Second, there is also a smaller literature that shows that cultural characteristics influence investors' decisions. This is because economic transactions are more likely between individuals with shared characteristics (the social homophily theory, Lazarsfeld and Merton 1954; McPherson, Smith-Lovin, and Cook 2001). Cable and Shane (1997), Franke et al. (2006), and Murnieks et al. (2011) provide empirical support for our context and show that the characteristics shared between individuals representing venture capitalists and individuals representing start-ups are relevant.[27]

We again rely on a gravity-type specification, applied to the investment behavior of venture capitalists.[28] Gravity models traditionally analyze flows (often of goods); here, we model investment flows from one region (i) to another (j), using a county $\times$ county Cartesian product as the unit of observation. Aggregating our data to this level yields $400 \times 400 = 160{,}000$ observations.[29] Counties i represent the origin of (actual or potential) investors, while counties j represent the destination of (actual or potential) start-up investments. Using county level data is meaningful, as it allows us to distinguish between regional and cross-regional investment patterns. We hypothesize that investors from areas with a strong sense of regional identity are less likely to invest in start-ups located outside their own region.

Our key explanatory variable is the share of reintroduced license plates in i, serving as a proxy for regional identity. To absorb unobserved heterogeneity in start-up destinations, we include county j fixed effects. However, this precludes the inclusion of county i fixed

[25] This is a large and established literature on the question of why investors are biased towards assets that they are geographically closer to.[26] It has also been noted that this pattern persists among venture capitalists (see Hoban Jr. 1976; Coval and Moskowitz 1999; Zacharakis and Shepherd 2001; Cumming and Dai 2010)

[27] The characteristics in which they are interested are similar educational or work background, "way of thinking", demographic characteristics, work values, and perceived power equality. In this paper, we investigate how history has affected the degree to which regional identity shapes individuals' (perceived) shared characteristics and, as such, their investments.

[28] This analysis builds on our more detailed study of the relationship between regional identity and the local investment bias of venture capitalists, which includes further robustness checks and an instrumental variable approach (Wahl and Huning 2023).

[29] Since distance from a county to itself is undefined, all observations where $i = j$ are excluded, reducing N to 159,600. Additional missing control variables lead to further data loss.

effects, which we address by including a rich set of geographic and development controls for investor counties. These include average elevation, population, and the share of industrial buildings (as of 2010).

An important alternative mechanism is that information flows between regions—facilitated, for instance, by shared newspapers—could drive investment decisions. These patterns may themselves be shaped by historical regional identity, but they represent a distinct channel. To control for this, we include a dummy equal to one if counties i and j share at least one newspaper. We also consider Facebook's Social Connectedness Index (SCI), a widely used proxy for social proximity (Kuchler et al. 2020). Results using either measure are highly similar; the correlation between the common newspaper dummy and the log of the SCI is 0.65. When both are included, only the SCI remains significant. This suggests that both capture similar dimensions of social proximity, and controlling for either is sufficient.[30]

The model regresses venture capital investment flows on geographic distance, information flows, and characteristics of the investor counties.[31] A descriptive overview of the county-pair dataset is provided in Table A.5 in the Online Appendix.

We estimate the following equation using OLS with standard errors clustered at the investor county level:

$$I_{ij} = \alpha + \beta ln(Identity)i + \gamma ln(TD)ij + \delta LNP_{ij} + \theta' \mathbf{X}i + \pi j + \epsilon_{i,j}, \tag{2}$$

where I_{ij} is the number of investments from county i to start-ups in county j, $ln(Identity)i$ is the log share of reintroduced UZ license plates in i, $ln(Dij)$ is the log of (as the crow flies) distance between i and j (in km), LNP_{ij} is a newspaper overlap dummy, $\mathbf{X}i$ is a vector of investor-county controls, πj are fixed effects for start-up counties, and ϵ_{ij} is the error term.

Table 2 reports estimation results from equation 2 using PPML. Distance is negatively and significantly associated with investment volumes. The identity variable (reintroduced UZ share) also has a significant negative coefficient, while the newspaper dummy shows a

[30] For space reasons, regression results using the SCI are not shown but are available upon request.

[31] Geographic proximity is captured using "as-the-crow-flies" distances between county centroids. Results would be virtually identical if were were to use travel time (in hours) as alternative proxy for information flows (following Ellis, Madureira, and Underwood 2020).

positive but not significant effect. These results suggest that investors are more likely to invest locally, and that higher regional identity is associated with significantly lower overall investment activity. This supports the broader literature on local bias, although the limited role of information flows is somewhat unexpected.

Most importantly, the regional identity measure has an economically meaningful effect on investor behavior. It suggests that strong local identity—or high "groupiness"—discourages investment beyond one's region. Additionally, the coefficient on distance decreases with the inclusion of the newspaper variable, indicating that part of the distance effect may reflect underlying information frictions. Finally, the results remain robust even when limiting the sample to investor-active counties (column 6), mitigating concerns about selection into investor activity.

Table 2: Explaining Investments with a Gravity-type Model

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. var.	Number of investments$_{ij}$					
Sample	All county pairs					County pairs with investors
ln(Distance)$_{i\to j}$ in km	-0.843***	-0.767***	-0.718***	-0.314***	-0.313***	-0.330***
	(0.0538)	(0.078)	(0.103)	(0.105)	(0.104)	(0.121)
ln(Percent Vehicles with reintroduced UZs)$_i$		-0.692***	-0.695***	-0.517***	-0.512***	-0.499***
		(0.216)	(0.217)	(0.112)	(0.115)	(0.116)
Same newspaper$_{ij}$			0.286	0.473	0.469	0.332
			(0.271)	(0.367)	(0.369)	(0.450)
County dummies (j)	✓	✓	✓	✓	✓	✓
Elevation and population (i)	–	–	–	✓	✓	✓
Share of industry buildings (i)	–	–	–	–	✓	✓
Observations	106,800	106,800	106,800	102,833	102,833	32,844
R^2	0.681	0.615	0.611	0.597	0.599	0.602

Notes. Standard errors clustered on county level are in parentheses. Coefficient is statistically different from zero at the ***1 percent, **5 percent, and *10 percent level. The units of observation are German county pairs (based on counties as of 2023). All regressions include a constant not reported. Elevation and population controls include the average elevation and the natural logarithm of the total population of each $county_i$. The share of industry buildings is measured in 2010.

4.3 The Political Consequences of Regional Identity

As a final step, we examine the cross-sectional relationship between regional identity and voting behavior in federal elections.

We argue that regional identity should also materialize itself in the ballot box. In the context of the UK, Goodhart (2017) has coined the dualism between "the Anywheres", i.e. cosmopolitan people who believe in universal values and view borders mostly as frictions, and the "Somewheres", people who do not regularly move across regional borders, may feel threatened by globalism, and instead seek refuge in smaller entities such as the county or even the family—and in our case—the region. Shayo (2009) has theorized that identity (albeit national identity in his case) is negatively related to ideas of redistribution.

The German conservative parties, CDU and CSU, have traditionally relied on rhetoric of regional identity. For the CSU, this goes from wearing Bavarian costumes to drinking the local beer in public, celebrating their dialect, as well as portraying Bavaria as "the preliminary stage to Paradise."[32] Also, the CDU engages in local customs, for example, by lobbying to bring back local dialects to the official, such as street signs.[33] The far-right AfD has, of all parties in the current Bundestag, the strongest nationalistic profile, with a clear focus on what they regard as German identity, traditions, and cultural roots.[34]

In contrast, the party that is most strongly associated with redistribution in the German context is the Social Democratic Party (SPD). We therefore hypothesize that its results are negatively correlated with our measure of regional identity. In the same spirit, we expect a positive relationship between regional identity and the share of the anti-globalist (and far-right) parties.[35] Combining the arguments of Goodhart and Shayo, we argue that liberalism and the ideal of open markets could be crushed between advocates of identity and supporters of redistribution. The party that is associated with liberal ideas, and probably also cosmopolitanism, is the Free Democratic Party (FDP). We expect a negative relationship between their results and regional identity, albeit a smaller effect than for the SPD.

To test this hypothesis, we estimate variants of the following regression equation using

[32]The quote is from former prime minister Seehofer, https://www.sueddeutsche.de/bayern/politischer-aschermittwoch-von-gemolkenen-kuehen-und-fischkrapferln-1.2356821. Ford (2007) discusses how the CSU formed a Bavarian identity.

[33]https://www.cdu-nrw-fraktion.de/artikel/lokale-identitaet-staerken.

[34]Examples include the proposed renationalisation of parliamentary control, research funding, as well as agricultural policy.

[35]These are grouped by the data provider as AfD, NPD, Republikaner, die Rechte, DVU, III. Weg, FAP, DDD, DSU.

OLS, clustering standard errors at the county level:

$$y_i = \alpha + \beta ln(Identity)_i + \gamma' \mathbf{X}_i + \epsilon_i \tag{3}$$

Where y_i denotes one of the following outcome variables: the average vote share in federal elections from 1980 to 2019 for the parties "Die Linke" (the left wing populist party/former GDR socialists), "Die Grünen" (the Green/ecologist party), the SPD (Social Democrats), the FDP (Liberal Democrats), the CDU/CSU (Catholic/Conservative party), and the AfD (right wing populist/extremist party). These are all parties that were represented in the Bundestag—this means they received more than five percent of the vote in at least one election during this period. In addition, there are several smaller parties with more radical or extreme political platforms. On the far left, these include the DKP (German Communist Party) and the BSA (Bund Sozialistischer Arbeiter), among others. On the far right, parties such as the DVU (German People's Union), NPD (National Democratic Party), and REP (The Republicans) are included. The GERDA data set provides aggregated vote shares for both far-left and far-right parties, including the two largest: Die Linke and the AfD. We use these aggregated shares—"Share Far Left" and "Share Far Right"—to test our hypotheses about ideological voting patterns. For this purpose, we additionally compute "Share Right Parties". This includes the vote shares of far-right parties plus the CDU/CSU. Similarly, we also bin which far-left parties, the SPD, and the Greens into our "Share Left Parties"(see Heddesheimer et al. 2025, for more details).[36]

$ln(Identity)_i$ is the natural logarithm of the share of vehicles with reintroduced UZs in 2019 in municipality i, as before. X_i is a vector of historical and contemporary control variables, including a municipality's latitude, longitude, their interaction term, a dummy for the five largest cities (Berlin, Hamburg, Munich, Cologne, Frankfurt am Main), a dummy for uninhabited areas ("Gemeindefreie Gebiete"), a dummy for municipalities in abolished counties with reintroduced UZs, and a dummy for municipalities that lost population between 1987 and 2019. Additional controls include the logarithm of average luminosity in 2021, the distance to the nearest concentration camp or subcamp (in km), a dummy variable for former GDR municipalities, a university dummy, the share of Catholics as of 2022, a dummy variable for historical war-related battles (1250–1789), a po-

[36] "Share Far Left" includes the following parties: BSA, BWK, DKP, KBW, KPD, SGPD, SpAD, V, and Die Linke. "Share Far Right" includes: AfD, BF_B, DDD, DG, Die Rechte, DNS, DRP, DSU, DVU, FAP, NPD, REP, and Dritter Weg.

litical fragmentation index (average number of states a municipality belonged to between 1250 and 1789), and the HPI index of historical political instability. These control variables are informed by prior research on the determinants of voting behavior in Germany (see section **??**) and by our own findings on the historical roots of regional identity (see section **??**). ϵ_i denotes the error term.

Results from estimating equation 3 for the vote share of individual parties , including the full set of control variables, are reported in Table 3.[37] The negative association is statistically significant only for the SPD and Die Linke. Vote shares for the liberal FDP and the conservative CDU/CSU do not show a statistically significant relationship with regional identity. Similarly, we do not observe a significant association in the full sample period for the far-right AfD. However, for the most recent federal election in 2025, the coefficient on regional identity is significantly positive, suggesting that identity may have played a more prominent role in shaping AfD support in this electoral context.

Table 3: Regional Identity and Voting Behavior in Federal Elections—Individual Party Results

Dep. Var.	(1)	(2)	(3)	(4)	(5)	(6)
	Vote Share of					
	Die Linke	Grüne	SPD	FDP	CDU/CSU	AfD
ln(Percent of Vehicles with reintroduced UZs)	-0.0014***	-0.0003	-0.0071***	0.0001	0.0009	0.00107
	(0.0005)	(0.0005)	(0.0023)	(0.0007)	(0.0018)	(0.001)
All Controls	✓	✓	✓	✓	✓	✓
Observations	10,635	10,635	10,635	10,635	10,635	10,635
R^2	0.906	0.458	0.571	0.415	0.739	0.775

Notes. Standard errors clustered on county level in parentheses. Coefficient is statistically different from zero at the ***1 percent, **5 percent, and *10 percent level. The unit of observation are German municipalities in 2010. All regressions include a constant not reported. Control variables include a municipality's latitude, longitude, their interaction term, a dummy for the five largest cities (Berlin, Hamburg, Munich, Cologne, Frankfurt am Main), a dummy for uninhabited areas ("Gemeindefreie Gebiete"), a dummy for municipalities in abolished counties with reintroduced UZs, and a dummy for municipalities that lost population between 1987 and 2019. Additional controls include the logarithm of average luminosity in 2021, the distance to the nearest concentration camp or subcamp (in km), a dummy for former GDR municipalities, a university dummy, the share of Catholics as of 2022, a dummy for historical war-related battles (1250–1789), a political fragmentation index (average number of states a municipality belonged to between 1250 and 1789), and the HPI index of historical political instability.

[37] Results of simple bivariate regressions without any controls are virtually identical. They are not shown due to saving space but are available from the authors upon request.

Results for the aggregated left wing and right wing voting shares are presented in Table 4. They indicate that regional identity is significantly positively associated with the vote shares of right wing and right wing extremist parties, while being significantly negatively associated with those of left wing and far-left parties.

Overall, the findings offer strong support for our hypothesis: municipalities with higher levels of regional identity tend to exhibit significantly lower electoral support for left wing and far-left parties, and significantly higher support for right wing and far-right parties.

Table 4: Regional Identity and Left and Right wing Voting in Federal Elections

	(1)	(2)	(3)	(4)
Dep. Var.	Vote Share of			
	Left Parties	Far Left Parties	Right Parties	Far Right
ln(Percent of Vehicles with reintroduced UZs)	-0.0088***	-0.0013***	0.0071***	0.0065***
	(0.0024)	(0.0005)	(0.0022)	(0.0012)
All controls	✓	✓	✓	✓
Observations	10,635	10,635	10,635	10,635
R^2	0.541	0.919	0.596	0.824

Notes. Standard errors clustered on county level in parentheses. Coefficient is statistically different from zero at the ***1 percent, **5 percent, and *10 percent level. The unit of observation are German municipalities in 2010. All regressions include a constant not reported. Control variables include a municipality's latitude, longitude, their interaction term, a dummy for the five largest cities (Berlin, Hamburg, Munich, Cologne, Frankfurt am Main), a dummy for uninhabited areas ("Gemeindefreie Gebiete"), a dummy for municipalities in abolished counties with reintroduced UZs, and a dummy for municipalities that lost population between 1987 and 2019. Additional controls include the logarithm of average luminosity in 2021, the distance to the nearest concentration camp or subcamp (in km), a dummy for former GDR municipalities, a university dummy, the share of Catholics as of 2022, a dummy for historical war-related battles (1250–1789), a political fragmentation index (average number of states a municipality belonged to between 1250 and 1789), and the HPI index of historical political instability.

5 Conclusion

This paper is the first systematic quantitative study of the link between the historical origins and economic consequences of regional identity. We show how past incidences of political instability translate into differences in local identities which then explain finan-

cial behavior. Shared experience and a common regional identity are crucial to individuals and relevant to their decisions. These elements shape their expectations about who they are similar to, who they can trust, and who will be a safe keepsake for their investment.

Our findings support the idea that intangible, unconscious, and yet unexplored aspects of human life shape economic decisions and interactions. Lacking outcomes of investment success, we cannot say whether this form of local bias among investors is rational. Is regional identity a good indicator of shared characteristics? Is regional identity just another friction in the labor market? Or does a strong regional identity foster economic exchange due to increased trust? Or does it instead make individuals, like employees and investors, excessively skeptical of a stranger? We developed a defensible measure of regional identity in Germany, but are German investors more "groupy" than investors in other countries, or does regional identity carry equivalent weight in all modern societies? All these questions are worthwhile to investigate, also in the long-run.

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Online Appendix

A.1 Overview of the reintroduced UZs

A.1.1 Constructing the "% Vehicles with reintroduced UZs" Variable

Table A.1 lists all reintroduced UZs of counties that were incorporated into others, the date they became available again, the contemporary county that reintroduced them and their federal state. The information depicted in the table comes from a list of all officially recognized UZs as of 12.09.2018 from the Federal Motor Transport Authority (Kraftfahrt-Bundesamt 2018), and a list of reintroduced UZs of incorporated counties in the Wikipedia entry on German license plate liberalization ("Kennzeichenliberalisierung") https://de.wikipedia.org/wiki/Kennzeichenliberalisierung (last accessed 15th July, 2022). As already stated in the main text, 170 counties reintroduced 355 old UZs. To calculate the share of UZs incorporated in each municipality, we merge this list with the data set of all UZs registered in each municipality that we purchased from the KBA by both the UZ and the county name. In doing so, we ignore the UZs of incorporated counties that are registered outside of the counties that decided to reintroduce them, because it is unclear what signal these UZs send. Then we calculate the sum of all UZs and of reintroduced UZs of incorporated counties in each municipality, divide both figures by each other, and collapse the data on municipality-level.

Table A.1: Reintroduced UZs in German counties as of 1st January 2019

UZ	Date of reintroduction	County of reintroduction	State
ÖHR	10.02.2015	Hohenlohekreis	BW
LEO	25.02.2013	Landkreis Böblingen	BW
NT	10.11.2014	Landkreis Esslingen	BW
HCH	19.02.2018	Landkreis Freudenstadt	BW
HOR	02.12.2013	Landkreis Freudenstadt	BW
WOL	19.02.2018	Landkreis Freudenstadt	BW
VAI	14.07.2014	Landkreis Ludwigsburg	BW
BH	09.12.2013	Landkreis Rastatt	BW
BK	01.09.2018	Landkreis Schwäbisch Hall	BW
CR	28.03.2014	Landkreis Schwäbisch Hall	BW
SÄK	15.03.2021	Landkreis Waldshut	BW

Table A.1 – *Continued*

MGH	07.01.2014	Main-Tauber-Kreis	BW
BCH	25.02.2013	Neckar-Odenwald-Kreis	BW
BH	30.03.2015	Ortenaukreis	BW
KEL	31.03.2014	Ortenaukreis	BW
LR	31.03.2014	Ortenaukreis	BW
WOL	31.03.2014	Ortenaukreis	BW
GD	25.02.2013	Ostalbkreis	BW
BK	02.12.2013	Rems-Murr-Kreis	BW
HCH	25.02.2013	Zollernalbkreis	BW
NEC	01.12.2014	Coburg	BY
FDB	11.07.2013	Landkreis Aichach-Friedberg	BY
LF	01.10.2016	Landkreis Altötting	BY
BUL	12.07.2013	Landkreis Amberg-Sulzbach	BY
ESB	12.07.2013	Landkreis Amberg-Sulzbach	BY
NAB	12.07.2013	Landkreis Amberg-Sulzbach	BY
SUL	12.07.2013	Landkreis Amberg-Sulzbach	BY
DKB	10.07.2013	Landkreis Ansbach	BY
FEU	10.07.2013	Landkreis Ansbach	BY
ROT	10.07.2013	Landkreis Ansbach	BY
ALZ	11.07.2013	Landkreis Aschaffenburg	BY
SMÜ	01.03.2017	Landkreis Augsburg	BY
WER	01.03.2017	Landkreis Augsburg	BY
BRK	10.07.2013	Landkreis Bad Kissingen	BY
HAB	10.07.2013	Landkreis Bad Kissingen	BY
WOR	10.07.2013	Landkreis Bad Tölz-Wolfratshausen	BY
EBS	10.07.2013	Landkreis Bayreuth	BY
ESB	10.07.2013	Landkreis Bayreuth	BY
KEM	10.07.2013	Landkreis Bayreuth	BY
MÜB	10.07.2013	Landkreis Bayreuth	BY
PEG	10.07.2013	Landkreis Bayreuth	BY
BGD	15.09.2016	Landkreis Berchtesgadener Land	BY
LF	15.09.2016	Landkreis Berchtesgadener Land	BY
REI	15.09.2016	Landkreis Berchtesgadener Land	BY
KÖZ	10.07.2013	Landkreis Cham	BY
ROD	10.07.2013	Landkreis Cham	BY
WÜM	10.07.2013	Landkreis Cham	BY
NEC	10.07.2013	Landkreis Coburg	BY

Table A.1 – *Continued*

WER	10.07.2013	Landkreis Dillingen a.d.Donau	BY
LAN	01.03.2017	Landkreis Dingolfing-Landau	BY
NÖ	10.07.2013	Landkreis Donau-Ries	BY
HÖS	02.02.2015	Landkreis Erlangen-Höchstadt	BY
EBS	10.07.2013	Landkreis Forchheim	BY
PEG	10.07.2013	Landkreis Forchheim	BY
GRA	10.07.2013	Landkreis Freyung-Grafenau	BY
WOS	10.07.2013	Landkreis Freyung-Grafenau	BY
KRU	13.07.2013	Landkreis Günzburg	BY
EBN	01.04.2014	Landkreis Haßberge	BY
GEO	01.04.2014	Landkreis Haßberge	BY
HOH	01.04.2014	Landkreis Haßberge	BY
MÜB	04.08.2014	Landkreis Hof	BY
NAI	04.08.2014	Landkreis Hof	BY
REH	04.08.2014	Landkreis Hof	BY
SAN	04.08.2014	Landkreis Hof	BY
MAI	10.07.2013	Landkreis Kelheim	BY
PAR	10.07.2013	Landkreis Kelheim	BY
RID	10.07.2013	Landkreis Kelheim	BY
ROL	10.07.2013	Landkreis Kelheim	BY
SAN	10.07.2013	Landkreis Kronach	BY
EBS	10.07.2013	Landkreis Kulmbach	BY
SAN	10.07.2013	Landkreis Kulmbach	BY
MAI	25.07.2014	Landkreis Landshut	BY
MAL	25.07.2014	Landkreis Landshut	BY
ROL	25.07.2014	Landkreis Landshut	BY
VIB	25.07.2014	Landkreis Landshut	BY
STE	16.07.2013	Landkreis Lichtenfels	BY
OBB	15.01.2018	Landkreis Miltenberg	BY
AIB	10.07.2013	Landkreis München	BY
WOR	10.07.2013	Landkreis München	BY
SOB	10.07.2013	Landkreis Neuburg-Schrobenhausen	BY
PAR	10.07.2013	Landkreis Neumarkt i.d.OPf.	BY
SEF	10.07.2013	Landkreis Neustadt a.d.Aisch-Bad Windsheim	BY
UFF	10.07.2013	Landkreis Neustadt a.d.Aisch-Bad Windsheim	BY
ESB	10.07.2013	Landkreis Neustadt a.d.Waldnaab	BY
VOH	10.07.2013	Landkreis Neustadt a.d.Waldnaab	BY

Table A.1 – *Continued*

ILL	10.07.2013	Landkreis Neu-Ulm	BY
ESB	15.07.2013	Landkreis Nürnberger Land	BY
HEB	15.07.2013	Landkreis Nürnberger Land	BY
N	15.07.2013	Landkreis Nürnberger Land	BY
PEG	15.07.2013	Landkreis Nürnberger Land	BY
FÜS	10.07.2013	Landkreis Ostallgäu	BY
MOD	10.07.2013	Landkreis Ostallgäu	BY
VIT	01.03.2018	Landkreis Regen	BY
KÖN	10.07.2013	Landkreis Rhön-Grabfeld	BY
MET	10.07.2013	Landkreis Rhön-Grabfeld	BY
AIB	10.07.2013	Landkreis Rosenheim	BY
WS	10.07.2013	Landkreis Rosenheim	BY
HIP	11.07.2013	Landkreis Roth	BY
EG	10.07.2013	Landkreis Rottal-Inn	BY
GRI	10.07.2013	Landkreis Rottal-Inn	BY
VIB	10.07.2013	Landkreis Rottal-Inn	BY
BUL	10.07.2013	Landkreis Schwandorf	BY
NAB	10.07.2013	Landkreis Schwandorf	BY
NEN	10.07.2013	Landkreis Schwandorf	BY
OVI	10.07.2013	Landkreis Schwandorf	BY
ROD	10.07.2013	Landkreis Schwandorf	BY
GEO	10.07.2013	Landkreis Schweinfurt	BY
WOR	10.07.2013	Landkreis Starnberg	BY
BOG	02.07.2018	Landkreis Straubing-Bogen	BY
MAL	02.07.2018	Landkreis Straubing-Bogen	BY
KEM	10.07.2013	Landkreis Tirschenreuth	BY
LF	14.10.2016	Landkreis Traunstein	BY
SOG	16.09.2013	Landkreis Weilheim-Schongau	BY
GUN	10.07.2013	Landkreis Weißenburg-Gunzenhausen	BY
MAK	10.07.2013	Landkreis Wunsiedel i.Fichtelgebirge	BY
REH	10.07.2013	Landkreis Wunsiedel i.Fichtelgebirge	BY
SEL	10.07.2013	Landkreis Wunsiedel i.Fichtelgebirge	BY
OCH	10.07.2013	Landkreis Würzburg	BY
BER	19.03.2013	Landkreis Barnim	BB
EW	19.03.2013	Landkreis Barnim	BB
KW	02.07.2015	Landkreis Dahme-Spreewald	BB
LC	02.07.2015	Landkreis Dahme-Spreewald	BB

Table A.1 – *Continued*

LN	02.07.2015	Landkreis Dahme-Spreewald	BB
FI	02.04.2013	Landkreis Elbe-Elster	BB
LIB	29.05.2013	Landkreis Elbe-Elster	BB
NAU	04.01.2016	Landkreis Havelland	BB
RN	04.01.2016	Landkreis Havelland	BB
FRW	18.03.2013	Landkreis Märkisch-Oderland	BB
SEE	18.03.2013	Landkreis Märkisch-Oderland	BB
SRB	18.03.2013	Landkreis Märkisch-Oderland	BB
CA	15.03.2013	Landkreis Oberspreewald-Lausitz	BB
SFB	15.03.2013	Landkreis Oberspreewald-Lausitz	BB
BSK	01.09.2017	Landkreis Oder-Spree	BB
EH	01.09.2017	Landkreis Oder-Spree	BB
FW	01.09.2017	Landkreis Oder-Spree	BB
KY	18.03.2013	Landkreis Ostprignitz-Ruppin	BB
NP	18.03.2013	Landkreis Ostprignitz-Ruppin	BB
WK	18.03.2013	Landkreis Ostprignitz-Ruppin	BB
FOR	19.03.2013	Landkreis Spree-Neiße	BB
GUB	19.03.2013	Landkreis Spree-Neiße	BB
SPB	19.03.2013	Landkreis Spree-Neiße	BB
ANG	03.04.2014	Landkreis Uckermark	BB
PZ	03.04.2014	Landkreis Uckermark	BB
SDT	03.04.2014	Landkreis Uckermark	BB
TP	03.04.2014	Landkreis Uckermark	BB
USI	02.01.2013	Hochtaunuskreis	HE
DIL	02.05.2014	Lahn-Dill-Kreis	HE
DI	02.01.2013	Landkreis Darmstadt-Dieburg	HE
ROF	01.08.2013	Landkreis Hersfeld-Rotenburg	HE
HOG	02.01.2013	Landkreis Kassel	HE
WOH	02.01.2013	Landkreis Kassel	HE
WEL	02.01.2013	Landkreis Limburg-Weilburg	HE
BID	02.01.2013	Landkreis Marburg-Biedenkopf	HE
FKB	04.11.2013	Landkreis Waldeck-Frankenberg	HE
WA	04.11.2013	Landkreis Waldeck-Frankenberg	HE
HU	15.06.2016	Main-Kinzig-Kreis	HE
GN	02.01.2013	Main-Kinzig-Kreis	HE
SLÜ	02.01.2013	Main-Kinzig-Kreis	HE
SWA	15.08.2013	Rheingau-Taunus-Kreis	HE

Table A.1 – *Continued*

FZ	16.03.2015	Schwalm-Eder-Kreis	HE
MEG	16.03.2015	Schwalm-Eder-Kreis	HE
ZIG	16.03.2015	Schwalm-Eder-Kreis	HE
WIZ	16.09.2013	Werra-Meißner-Kreis	HE
BÜD	02.01.2013	Wetteraukreis	HE
HGN	01.08.2013	Landkreis Ludwigslust-Parchim	MV
LBZ	01.08.2013	Landkreis Ludwigslust-Parchim	MV
LWL	01.08.2013	Landkreis Ludwigslust-Parchim	MV
PCH	01.08.2013	Landkreis Ludwigslust-Parchim	MV
STB	01.08.2013	Landkreis Ludwigslust-Parchim	MV
AT	18.03.2013	Landkreis Mecklenburgische Seenplatte	MV
DM	22.07.2013	Landkreis Mecklenburgische Seenplatte	MV
MC	18.03.2013	Landkreis Mecklenburgische Seenplatte	MV
MST	22.07.2013	Landkreis Mecklenburgische Seenplatte	MV
MÜR	22.07.2013	Landkreis Mecklenburgische Seenplatte	MV
NZ	18.03.2013	Landkreis Mecklenburgische Seenplatte	MV
RM	18.03.2013	Landkreis Mecklenburgische Seenplatte	MV
WRN	18.03.2013	Landkreis Mecklenburgische Seenplatte	MV
GDB	02.04.2013	Landkreis Nordwestmecklenburg	MV
GVM	02.04.2013	Landkreis Nordwestmecklenburg	MV
WIS	02.04.2013	Landkreis Nordwestmecklenburg	MV
BÜZ	18.03.2013	Landkreis Rostock	MV
DBR	18.03.2013	Landkreis Rostock	MV
GÜ	18.03.2013	Landkreis Rostock	MV
ROS	18.03.2013	Landkreis Rostock	MV
TET	18.03.2013	Landkreis Rostock	MV
ANK	14.03.2013	Landkreis Vorpommern-Greifswald	MV
GW	14.03.2013	Landkreis Vorpommern-Greifswald	MV
PW	14.03.2013	Landkreis Vorpommern-Greifswald	MV
SBG	10.07.2013	Landkreis Vorpommern-Greifswald	MV
UEM	14.03.2013	Landkreis Vorpommern-Greifswald	MV
WLG	14.03.2013	Landkreis Vorpommern-Greifswald	MV
GMN	15.03.2013	Landkreis Vorpommern-Rügen	MV
NVP	15.03.2013	Landkreis Vorpommern-Rügen	MV
RDG	15.03.2013	Landkreis Vorpommern-Rügen	MV
RÜG	15.03.2013	Landkreis Vorpommern-Rügen	MV
NOR	15.11.2012	Landkreis Aurich	NI

Table A.1 – *Continued*

SY	23.04.2018	Landkreis Diepholz	NI
BRL	15.11.2012	Landkreis Goslar	NI
CLZ	15.11.2012	Landkreis Goslar	NI
DUD	15.11.2012	Landkreis Göttingen	NI
HMÜ	15.11.2012	Landkreis Göttingen	NI
OHA	01.11.2016	Landkreis Göttingen	NI
ALF	15.11.2012	Landkreis Hildesheim	NI
EIN	15.11.2012	Landkreis Northeim	NI
GAN	15.11.2012	Landkreis Northeim	NI
BSB	11.06.2018	Landkreis Osnabrück	NI
MEL	11.06.2018	Landkreis Osnabrück	NI
WTL	11.06.2018	Landkreis Osnabrück	NI
BRV	15.11.2012	Landkreis Rotenburg (Wümme)	NI
RI	15.11.2012	Landkreis Schaumburg	NI
WAT	14.11.2012	Bochum	NW
WIT	14.11.2012	Ennepe-Ruhr-Kreis	NW
WAN	12.12.2012	Herne	NW
AH	01.02.2013	Kreis Borken	NW
BOH	01.02.2013	Kreis Borken	NW
LH	16.05.2014	Kreis Coesfeld	NW
JÜL	17.11.2012	Kreis Düren	NW
MON	15.07.2015	Kreis Düren	NW
SLE	15.07.2015	Kreis Düren	NW
SLE	20.02.2013	Kreis Euskirchen	NW
ERK	02.09.2013	Kreis Heinsberg	NW
GK	02.09.2013	Kreis Heinsberg	NW
GEL	10.06.2014	Kreis Kleve	NW
BÜR	24.11.2014	Kreis Paderborn	NW
CAS	13.11.2012	Kreis Recklinghausen	NW
GLA	13.11.2012	Kreis Recklinghausen	NW
BLB	13.11.2012	Kreis Siegen-Wittgenstein	NW
LP	03.12.2012	Kreis Soest	NW
BF	03.07.2013	Kreis Steinfurt	NW
TE	03.07.2013	Kreis Steinfurt	NW
LH	01.09.2015	Kreis Unna	NW
LÜN	24.11.2012	Kreis Unna	NW
KK	02.03.2015	Kreis Viersen	NW

Table A.1 – *Continued*

BE	22.04.2014	Kreis Warendorf	NW
DIN	03.12.2012	Kreis Wesel	NW
MO	03.12.2012	Kreis Wesel	NW
OP	03.08.2015	Leverkusen	NW
GV	19.08.2015	Rhein-Kreis Neuss	NW
MON	02.07.2013	Städteregion Aachen	NW
ROK	15.07.2013	Donnersbergkreis	RP
PRÜ	14.11.2012	Eifelkreis Bitburg-Prüm	RP
BKS	26.11.2012	Landkreis Bernkastel-Wittlich	RP
ZEL	15.11.2012	Landkreis Cochem-Zell	RP
BIN	15.11.2012	Landkreis Mainz-Bingen	RP
MY	06.05.2013	Landkreis Mayen-Koblenz	RP
ZW	02.02.2015	Landkreis Südwestpfalz	RP
SAB	19.11.2012	Landkreis Trier-Saarburg	RP
GOA	15.11.2012	Rhein-Hunsrück-Kreis	RP
DIZ	08.07.2013	Rhein-Lahn-Kreis	RP
GOH	08.07.2013	Rhein-Lahn-Kreis	RP
ANA	09.11.2012	Erzgebirgskreis	SN
ASZ	09.11.2012	Erzgebirgskreis	SN
AU	09.11.2012	Erzgebirgskreis	SN
MAB	09.11.2012	Erzgebirgskreis	SN
MEK	09.11.2012	Erzgebirgskreis	SN
STL	09.11.2012	Erzgebirgskreis	SN
SZB	09.11.2012	Erzgebirgskreis	SN
ZP	09.11.2012	Erzgebirgskreis	SN
BIW	09.11.2012	Landkreis Bautzen	SN
HY	09.11.2012	Landkreis Bautzen	SN
KM	09.11.2012	Landkreis Bautzen	SN
LÖB	09.11.2012	Landkreis Görlitz	SN
NOL	09.11.2012	Landkreis Görlitz	SN
NY	09.11.2012	Landkreis Görlitz	SN
WSW	09.11.2012	Landkreis Görlitz	SN
ZI	09.11.2012	Landkreis Görlitz	SN
BNA	09.11.2012	Landkreis Leipzig	SN
GHA	09.11.2012	Landkreis Leipzig	SN
GRM	09.11.2012	Landkreis Leipzig	SN
MTL	09.11.2012	Landkreis Leipzig	SN

Table A.1 – *Continued*

WUR	09.11.2012	Landkreis Leipzig	SN
GRH	09.11.2012	Landkreis Meißen	SN
RG	09.11.2012	Landkreis Meißen	SN
RIE	09.11.2012	Landkreis Meißen	SN
BED	09.11.2012	Landkreis Mittelsachsen	SN
DL	09.11.2012	Landkreis Mittelsachsen	SN
FLÖ	09.11.2012	Landkreis Mittelsachsen	SN
HC	09.11.2012	Landkreis Mittelsachsen	SN
MW	09.11.2012	Landkreis Mittelsachsen	SN
RL	09.11.2012	Landkreis Mittelsachsen	SN
DZ	09.11.2012	Landkreis Nordsachsen	SN
EB	09.11.2012	Landkreis Nordsachsen	SN
OZ	09.11.2012	Landkreis Nordsachsen	SN
TG	09.11.2012	Landkreis Nordsachsen	SN
TO	09.11.2012	Landkreis Nordsachsen	SN
DW	12.11.2012	Landkreis Sächsische Schweiz-Osterzgebirge	SN
FTL	12.11.2012	Landkreis Sächsische Schweiz-Osterzgebirge	SN
SEB	12.11.2012	Landkreis Sächsische Schweiz-Osterzgebirge	SN
GC	09.11.2012	Landkreis Zwickau	SN
HOT	09.11.2012	Landkreis Zwickau	SN
WDA	09.11.2012	Landkreis Zwickau	SN
AE	09.11.2012	Vogtlandkreis	SN
OVL	09.11.2012	Vogtlandkreis	SN
PL	09.11.2012	Vogtlandkreis	SN
RC	09.11.2012	Vogtlandkreis	SN
GA	27.11.2012	Altmarkkreis Salzwedel	ST
KLZ	27.11.2012	Altmarkkreis Salzwedel	ST
HHM	27.11.2012	Burgenlandkreis	ST
NEB	27.11.2012	Burgenlandkreis	ST
NMB	27.11.2012	Burgenlandkreis	ST
WSF	27.11.2012	Burgenlandkreis	ST
ZZ	27.11.2012	Burgenlandkreis	ST
RSL	27.11.2012	Dessau-Roßlau	ST
AZE	27.11.2012	Landkreis Anhalt-Bitterfeld	ST
BTF	27.11.2012	Landkreis Anhalt-Bitterfeld	ST
KÖT	27.11.2012	Landkreis Anhalt-Bitterfeld	ST
ZE	27.11.2012	Landkreis Anhalt-Bitterfeld	ST

Table A.1 – *Continued*

BÖ	27.11.2012	Landkreis Börde	ST
HDL	27.11.2012	Landkreis Börde	ST
OC	27.11.2012	Landkreis Börde	ST
OK	27.11.2012	Landkreis Börde	ST
WMS	27.11.2012	Landkreis Börde	ST
WZL	27.11.2012	Landkreis Börde	ST
HBS	27.11.2012	Landkreis Harz	ST
QLB	27.11.2012	Landkreis Harz	ST
WR	27.11.2012	Landkreis Harz	ST
BRG	27.11.2012	Landkreis Jerichower Land	ST
GNT	27.11.2012	Landkreis Jerichower Land	ST
EIL	27.11.2012	Landkreis Mansfeld-Südharz	ST
HET	27.11.2012	Landkreis Mansfeld-Südharz	ST
ML	27.11.2012	Landkreis Mansfeld-Südharz	ST
SGH	27.11.2012	Landkreis Mansfeld-Südharz	ST
HV	27.11.2012	Landkreis Stendal	ST
OBG	27.11.2012	Landkreis Stendal	ST
GHC	27.11.2012	Landkreis Wittenberg	ST
JE	27.11.2012	Landkreis Wittenberg	ST
MER	27.11.2012	Saalekreis	ST
MQ	27.11.2012	Saalekreis	ST
QFT	27.11.2012	Saalekreis	ST
ASL	27.11.2012	Salzlandkreis	ST
BBG	27.11.2012	Salzlandkreis	ST
SBK	27.11.2012	Salzlandkreis	ST
SFT	27.11.2012	Salzlandkreis	ST
MED	20.04.2015	Kreis Dithmarschen	SH
ECK	15.11.2012	Kreis Rendsburg-Eckernförde	SH
ARN	29.11.2012	Ilm-Kreis	TH
IL	29.11.2012	Ilm-Kreis	TH
ART	29.11.2012	Kyffhäuserkreis	TH
SDH	29.11.2012	Kyffhäuserkreis	TH
SLN	29.11.2012	Landkreis Altenburger Land	TH
HIG	29.11.2012	Landkreis Eichsfeld	TH
WBS	29.11.2012	Landkreis Eichsfeld	TH
ZR	29.11.2012	Landkreis Greiz	TH
RU	29.11.2012	Landkreis Saalfeld-Rudolstadt	TH

Table A.1 – *Continued*

MGN	29.11.2012	Landkreis Schmalkalden-Meiningen	TH
NH	29.11.2012	Landkreis Sonneberg	TH
APD	29.11.2012	Landkreis Weimarer Land	TH
EIS	29.11.2012	Saale-Holzland-Kreis	TH
SRO	29.11.2012	Saale-Holzland-Kreis	TH
LBS	29.11.2012	Saale-Orla-Kreis	TH
PN	29.11.2012	Saale-Orla-Kreis	TH
SCZ	29.11.2012	Saale-Orla-Kreis	TH
LSZ	29.11.2012	Unstrut-Hainich-Kreis	TH
MHL	29.11.2012	Unstrut-Hainich-Kreis	TH
SLZ	29.11.2012	Wartburgkreis	TH

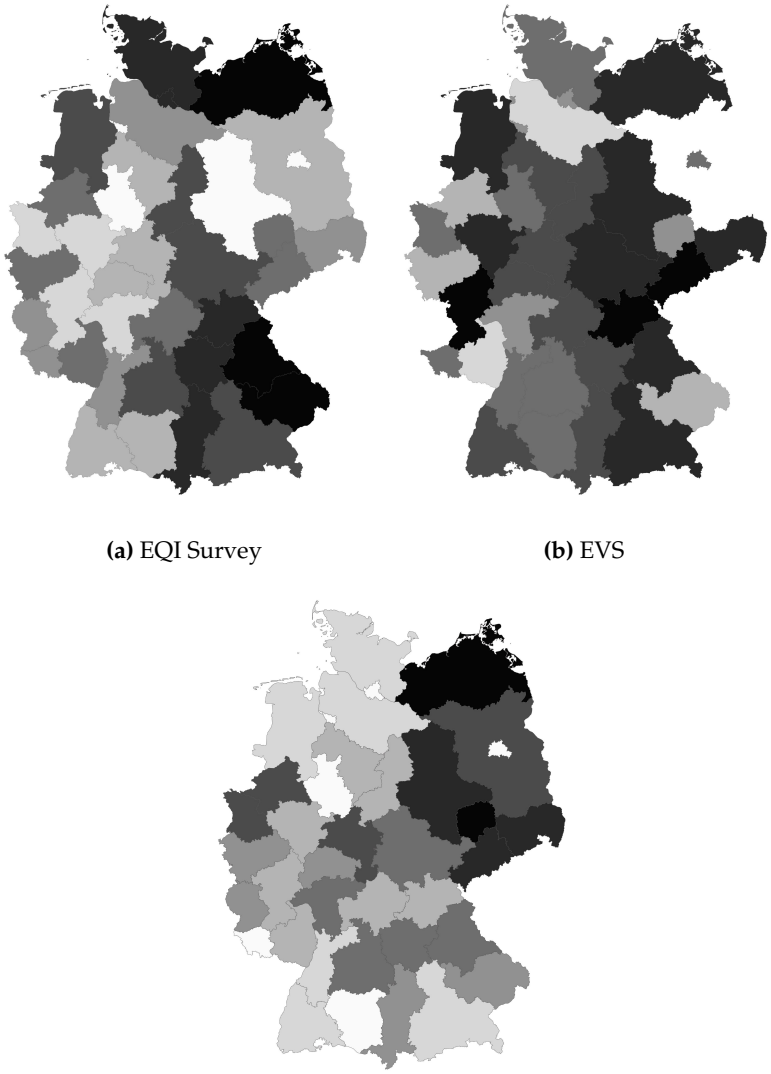
A.2 Comparison of the License-plate based Measure with Survey Questions on Regional Identity

We compare our license plate-based measure of regional identity with standard survey questions from two established and widely cited survey data sets, the longitudinal (1981–2008) data file of the European Values Survey (EVS) (EVS 2020) and the most recent (2021) European Quality of Government Index Survey Data Set (EQI) (Charron et al. 2022). Both surveys would allow one to calculate a regional identity measure at the level of the 38 German NUTS-2 regions.[38] From the EVS, we calculate the regional identity variable as follows: We start by considering the individual answers to the questions G001 ("Which of these geographical groups would you say you belong to first of all?") and G002 ("Which of these geographical groups would you say you belong to second of all?") which both can be answered with 1 ='Locality or town where you live', 2 ='Region or country where you live', 3'='Country as a whole', 4 = 'Europe' and 5 = 'The world as a whole'. We then define two intermediate variables, reprio_1 and reprio_2, where reprio_1=1 iff GOO1=2, otherwise 0, and reprio_2=1 iff G001=1, otherwise 0. From these, we construct our individual-level regional identity measure rescore which is defined as rescore=reprio_1+reprio_2 (and is missing if either G001 or G002 is missing). We then take the average of the rescore

[38] In principle NUTS-3 level (counties), however, the sample size within NUTS-3 regions is too low to allow for meaningful statistical analyses. For example, in the EVS, on average 13 people per NUTS-3 region were asked and in more than 50 % of the regions 11 or fewer people participated in the survey. Therefore, we aggregate the individual answers

variable over a NUTS-2 region and all survey waves to arrive at our final NUTS-2 level regional identity measure. From the EQI survey, we take the variable q23_2 reporting the answers to the question "People might feel different levels of attachment to where they live and to Europe, on a scale of 1-10 with '1' being 'not at all' and '10' being 'very attached' how closely attached do you feel about your region in (COUNTRY)". We averaged the individual answers over a NUTS-2 region to obtain our final regional identity variable from this survey.

Figure A.4 visualizes the spatial patterns of regional identity according to both surveys (Panels (a) and (b)) and the share of vehicles with reintroduced UZs (averaged over NUTS-2 regions) in Panel (c). As discussed in the main text, similar patterns are visible in all three maps. There are, however, more visible similarities between the EVS measure and the license plate variable than between the license plate variable and the measure derived from the EQI survey. It becomes also clear that there are significant differences between the EVS and the EQI measures. These differences are likely the result of the different scale and wording of the questions, a different pool of participants, and the survey period.



(a) EQI Survey

(b) EVS

(c) ln(% Vehicles with reintroduced UZs)

Note: The graphic shows the borders of the 38 German NUTS-2 regions. The darker the shades, the higher the regional identity of the people. The white regions are those with missing data

Figure A.4: Comparison of Regional Identity Measures

A.3 Further Validity Checks for the License-plate based Measure of Regional Identity

A.3.1 Relationship to the Local Frequency of Street Names with Regional Reference

To further corroborate the validity of our license-plate-based identity measure, we investigate its correlation with alternative measures of regional identity that are of a similar nature, i.e., based on revealed preferences and available at the municipality level. We are inspired by the idea of Oto-Peralias (2017), who measures local religiosity in Spain using the share of religious street names. We measure regional identity using the share of street names referencing a person who was born or lived in the municipality but is not generally well-known or famous outside the region of the village or town. These typically include streets named after mayors, priests, or entrepreneurs who founded a company in the locality or nearby. After a case-by-case assessment using Wikipedia and other available sources (e.g., the official website of the municipality administration or archives), this can also include streets named after artists, writers, architects, master builders, etc., who are not known throughout Germany but only in the region where they were active or lived.

We identify such street names for 12 municipalities in the state of Baden-Württemberg.[39] First, they were selected because they are all located in counties that reintroduced old, abolished UZs. Second, they were chosen to include places with a low, medium, and high share of reintroduced UZs (low, medium, and high relative to Baden-Württemberg). This selection ensures that we can analyze the relationship to street names with regional references by maximizing variation and enabling comparisons across all ranges of the license-plate-based measure.[40]

The selected municipalities are spread across all parts of the state and include small places in rural areas as well as larger places that are part of major agglomerations (e.g., Leonberg

[39]The municipalities are Birkenfeld, Neuenbürg, Rheinau, Bärenthal, Hettingen, Leonberg, Öhringen, Crailsheim, Schwäbisch Gmünd, Haigerloch, Mühlenbach, and Ahorn. Overall, after we have removed the 100 most common street names from the list, these 12 municipalities have 3,463 street names to be classified, of which 236 (around 7%) have a regional reference.

[40]Note also that the share of license plates is highly skewed. Therefore, there are many small and many large values. For example, the mean is 8.37%, the median is 2.5%, and the 99th percentile ranges from 42 to 50%. We selected four municipalities in the 25th percentile of the distribution to include places with low values ($< 0.086\%$), three municipalities from around the average of the distribution, and four from the 99th percentile to include places with very high values.

borders Stuttgart, the capital and largest city of the state). Baden-Württemberg is a state with substantial variation in the share (and availability) of license plates with reintroduced old UZs. It is also a region with highly heterogeneous settlement patterns, i.e., large agglomerations, sparsely populated rural areas, and more densely populated areas with many small and medium-sized villages and towns. Therefore, it seems to be the optimal region to sample a variety of cities and calculate their share of street names with regional references.

City councils decide on the names of streets, and it is presumed that, at least in the long run, the preferences of the local politicians reflect the preferences of the people living in the locality. Therefore, street names are another potentially valid measure of regional identity, which is based on revealed preferences–like our license-plate measure. We also argue that the share of street names with regional references is a valid measure of regional identity, as it might not only reflect the regional identity of the local people but could also directly indicate where parts of this identity originate. For example, a high share of notable people who are commemorated in street names could signify a source of local pride.

The correlation between the share of vehicles with a reintroduced UZ and the share of street names with regional references in these 12 municipalities is 0.8482 and significant at the 1% level. The clear correlation is also visible in Figure A.5, which shows a scatter plot of both variables. We conclude from this that both variables reflect the same underlying variation—variation in the degree of regional identity among these municipalities.

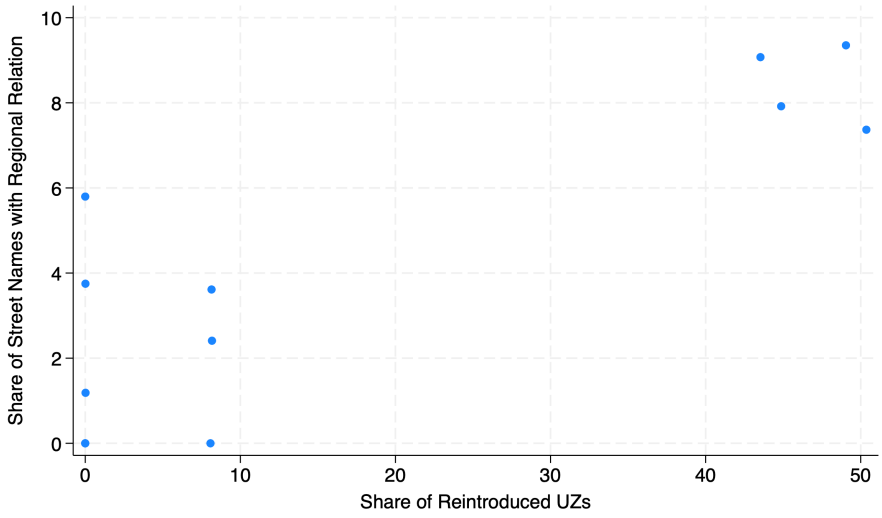


Figure A.5: The Relationship between the Share of Vehicles with Reintroduced UZs and Street Names with Regional Reference in 12 Municipalities in Baden-Württemberg

A.3.2 The Relationship to Personality Traits and Historical Characteristics of Regions

One criticism of our license-plate-based measure of regional identity is that it may reflect other characteristics of people, such as their personality, attitudes, or preferences. Similarly, it is possible that the license-plate measure systematically captures local differences in historical factors known to be important for long-term political, social, and economic development (e.g., pandemics, trade activity, or settlement history). We thus need to ensure that our measure does not systematically reflect either regional differences in relevant personality traits or in historical factors.

To address this concern, we aggregate our license-plate-based regional identity measure to the level of planning regions ("Raumordnungsregionen"), of which there are 96 in Germany. This aggregation allows us to merge the data with the planning-region-level dataset from Obschonka et al. (2024), which includes a host of relevant historical and geographical variables (e.g., elevation, soil quality, proximity to borders, or being part of the former Roman Empire in Germany). It also contains information about the regional prevalence of Big Five personality traits (agreeableness, extraversion, conscientiousness, openness, and neuroticism) as well as an entrepreneurial personality profile—a certain combination of the Big Five traits that psychological research associates with entrepreneurial

behavior. We then run several OLS regressions using the share of reintroduced license plates in a planning region as the dependent variable, one of the personality trait variables, and a set of historical and geographical covariates as regressors. We also include federal state fixed effects to account for time-invariant unobserved factors at the state level.

Table A.3 shows the results.[41] The regression results clearly indicate that there is no robustly significant relationship between our regional identity measure and any of the geographical or historical variables. There is only a weakly significant and negative relationship with one of the personality traits (conscientiousness), which is neither particularly strong nor theoretically intuitive. Based on these regressions, it is reasonable to conclude that our license-plate-based measure does not systematically reflect regional differences in personality traits, historical factors, or geography.

[41] For the exact sources and definitions of these variables, the reader is referred to (Obschonka et al. 2024).

A.3.3 Explaining the Share of Reintroduced UZs with a Spatial RDD at the Borders of Discontinued Counties

Table A.2: Results of Spatial RDD explaining the Share of Reintroduced UZs

	(1)	(2)	(3)
Dep. Var.	ln(% Vehicles with Reintroduced UZs)		
County has Reintroduced UZs	0.456***		-0.194***
	(0.0182)		(0.0273)
Discontinued County has Reintroduced UZs		1.342***	1.324***
		(0.0273)	(0.0270)
Linear Distance Polynomials	Yes	Yes	Yes
Linear Coordinates Polynomials	Yes	Yes	Yes
State Dummies	Yes	Yes	Yes
Observations	10,966	10,966	10,966
R^2	0.534	0.577	0.581

Notes. Heteroskedasticity robust standard errors in parentheses. Coefficient is statistically different from zero at the ***1 %, **5 %, and *10 % level. All regressions include a constant not reported. The table shows the second stage results of the spatial RDD estimation using OLS. Each regressions also includes federal state fixed effects. "Linear distance polyonmials" include the distance to the border of a discontinued, dominated county with reintroduced UZs (defined as being negative outside of the discontinued county) and the distance to the discontinued county border interacted with a dummy for discontinued, dominated counties with reintroduced UZs. Linear Coordinates Polynomials include latitude, longitude and their interaction of the centroid of each municipality.

Table A.3: Is our license-plate based measure explained by personality traits, history or geography?

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Var.	ln(% Vehicles with reintroduced Uzs)					
Extraversion	-1.143					
	(1.389)					
Agreeablness		-0.677				
		(2.815)				
Neuroticism			0.582			
			(1.802)			
Conscientiousness				3.001*		
				(1.658)		
Openness					-1.388	
					(1.931)	
Entrepreneurial personality						-0.00887
						(0.174)
Roman	-0.222	-0.247	-0.232	-0.419	-0.250	-0.258
	(0.287)	(0.282)	(0.311)	(0.298)	(0.278)	(0.303)
Location on major river	0.173	0.196	0.192	0.156	0.173	0.195
	(0.225)	(0.224)	(0.226)	(0.209)	(0.220)	(0.230)
Location on German border	0.313	0.265	0.289	0.288	0.279	0.266
	(0.245)	(0.236)	(0.250)	(0.237)	(0.233)	(0.245)
Elevation	-0.00116	-0.00129	-0.00125	-0.000859	-0.00109	-0.00126
	(0.00156)	(0.00158)	(0.00158)	(0.00156)	(0.00158)	(0.00158)
Ruggedness	0.000597	0.000518	0.000511	0.000409	0.000643	0.000415
	(0.00167)	(0.00175)	(0.00170)	(0.00168)	(0.00164)	(0.00167)
Soil suitability	-0.00625	-0.00508	-0.00611	-0.0103	-0.00485	-0.00577
	(0.0126)	(0.0126)	(0.0123)	(0.0128)	(0.0121)	(0.0125)
Location on coast	-0.00255	0.0443	0.0781	0.385	0.126	0.0849
	(0.478)	(0.512)	(0.473)	(0.503)	(0.480)	(0.473)
Celtic Oppida	0.0367	0.0412*	0.0411	0.0623**	0.0438*	0.0418
	(0.0257)	(0.0243)	(0.0251)	(0.0274)	(0.0247)	(0.0256)
Mean sunshine (h)	5.78e-05	0.000511	0.000380	0.00128	0.000441	0.000425
	(0.00239)	(0.00237)	(0.00238)	(0.00239)	(0.00232)	(0.00240)
Mean temperature (°C)	-0.138	-0.147	-0.149	-0.0709	-0.108	-0.146
	(0.202)	(0.203)	(0.202)	(0.201)	(0.214)	(0.203)
Hanse city	0.349	0.362	0.357	0.356	0.371	0.359
	(0.395)	(0.397)	(0.399)	(0.402)	(0.399)	(0.397)
No. of Plague outbreakes	-0.00889	-0.0109	-0.0104	-0.00807	-0.00802	-0.0108
	(0.0105)	(0.0102)	(0.0104)	(0.0102)	(0.0112)	(0.0105)
Location on coal strata	0.806	0.774	0.787	1.000*	0.806	0.790
	(0.514)	(0.536)	(0.531)	(0.516)	(0.516)	(0.525)
Federal State Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	96	96	96	96	96	96
R^2	0.540	0.537	0.538	0.558	0.541	0.537

Notes. Heteroskedasticity robust standard errors in parentheses. Coefficient is statistically different from zero at the ***1 %, **5 %, and *10 % level. All regressions include a constant not reported.

A.4 Mapsof the HRE Used for the Calculation of the Political Instability and Fragmentation Variables

A.4.1 Maps of the Territories of the HRE by Wolff (1877)

The area of a state ("reichsunmittelbares Territorium") is calculated based on shapefiles created from maps of the non-Italian parts of the Holy Roman Empire printed in Wolff (1877). One of those maps, "Deutschland beim Tode Karl des IV. im Jahre 1378" ("Germany at the death of Charles IV. in the year 1378") is shown below in Figure A.6. Note that this map incorrectly includes the state of the Teutonic Order, so when digitizing the map, we excluded this area.[42] To cross-validate the map of Wolff, we consulted several other historical atlases, including those of Darby and Fullard (1978), Stier et al. (1956), and Andree (1886) or Baldamus, Schwabe, and Koch (1914).

Note: This figure shows the original map of the HRE as printed in Wolff (1877). For our empirical analysis we digitized this map using GIS software.

Figure A.6: Germany at the Death of Charles IV. in the Year 1378 according to Wolff (1877)

[42] The maps are available here: http://gei-digital.gei.de/viewer/javax.faces.resource/pdf-icon32.png.xhtml?ln=images/ (accessed on January 22, 2016).

A.4.2 Frequency and Type of Territories in the HRE

In total, we identify 730 independent states, comprising 81 city-states, 89 ecclesiastical territories (including bishoprics, archbishoprics, and monastic states), and 560 secular territorial states. The latter group consists of two kingdoms (Bohemia and Prussia), 48 duchies, and 80 principalities.[43] In addition, we classify 16 republics—all located in present-day Switzerland—and 217 counties.[44] We also count 180 Herrschaften" (lordships) ruled by barons (Freiherren). Beyond these, there are seven imperial territories under direct control of the Emperor, including six grand bailiwicks (Landvogteien) and the Staufian lands, held by the Staufian emperors between the 11th and 13th centuries. Additionally, we include four Swedish-occupied territories following the Thirty Years' War. Finally, there are nine electorates—three of which are archbishoprics already included in the ecclesiastical count—that formed the most powerful group of states within the Empire.[45]

A.4.3 Historical Background to the Sampling Years

1. 1250 was the year of the death of Frederick II, the last Emperor of the Staufer dynasty, which had ruled the Empire as kings and emperors for over 110 years. The dynasty collapsed soon after in 1254 with the death of his only male heir, Konrad IV, who held the title King of Germany but was never crowned Emperor. This marked the beginning of the Great Interregnum", a 20-year period without a universally recognized emperor. Four rival kings were elected during this time, but none were able to assert authority across the Empire. The period, often described as one of insecurity, violence, and fragmentation, witnessed the emergence of many city-states (free and

[43] This category also includes nine landgraviates (Landgrafschaften), 17 margraviates (Markgrafschaften), and two princely counties (the Princely County of Burgundy and the Princely County of Tyrol), whose rulers held the same rank as princes despite their names suggesting comital origins.

[44] This figure includes four county palatinates (Pfalzgrafschaften), six burgraviates, and 207 ordinary counties. Among the former, the County Palatinate of the Rhine held the status of an electorate from the mid-13th century onward and was one of the most powerful states within the Empire. Counties were heterogeneous in both size and influence. For example, Württemberg—initially a county before becoming a duchy in 1495—was larger and fiscally stronger than many duchies and principalities.

[45] The titles of the electorates varied: some were designated as electoral principalities (Kurfürstentümer), others as margraviates or county palatinates. The Habsburg monarchy, for instance, held the title Archduchy of Austria".

imperial cities) and an increase in political disintegration.[46]

2. 1378 marked the death of Emperor Charles IV, often seen as a high point of political fragmentation within the Empire. The decentralization of authority was entrenched by the Golden Bull of 1356, which formalized the role of territorial princes in imperial elections. Although Charles IV is regarded as one of the most influential emperors of the medieval period, his financial difficulties led him to sell and pledge large portions of his territories, undermining the power and continuity of the Luxembourg dynasty and weakening imperial authority.

3. 1477 was the year Charles the Bold, Duke of Burgundy, died. His death triggered the collapse of the Duchy of Burgundy—then one of the most powerful European states, though nominally part of the HRE. The territory was subsequently partitioned: some parts fell to France, while others became smaller imperial entities (such as the Duchy of Brabant). Through dynastic marriage, the Habsburgs inherited the remaining Burgundian lands, marking the beginning of their ascent as a European great power and the onset of a gradual reduction in the Empire's political fragmentation.

4. 1556, the year following the Peace of Augsburg, which temporarily resolved religious conflict in the Empire by institutionalizing the confessional divide, also saw the abdication of Emperor Charles V. Though arguably the most powerful European ruler since antiquity, Charles V stepped down after failing to assert dominance over Protestant princes and maintain imperial cohesion. His abdication signaled a turning point for Habsburg authority, marking the beginning of its slow decline within the Empire.

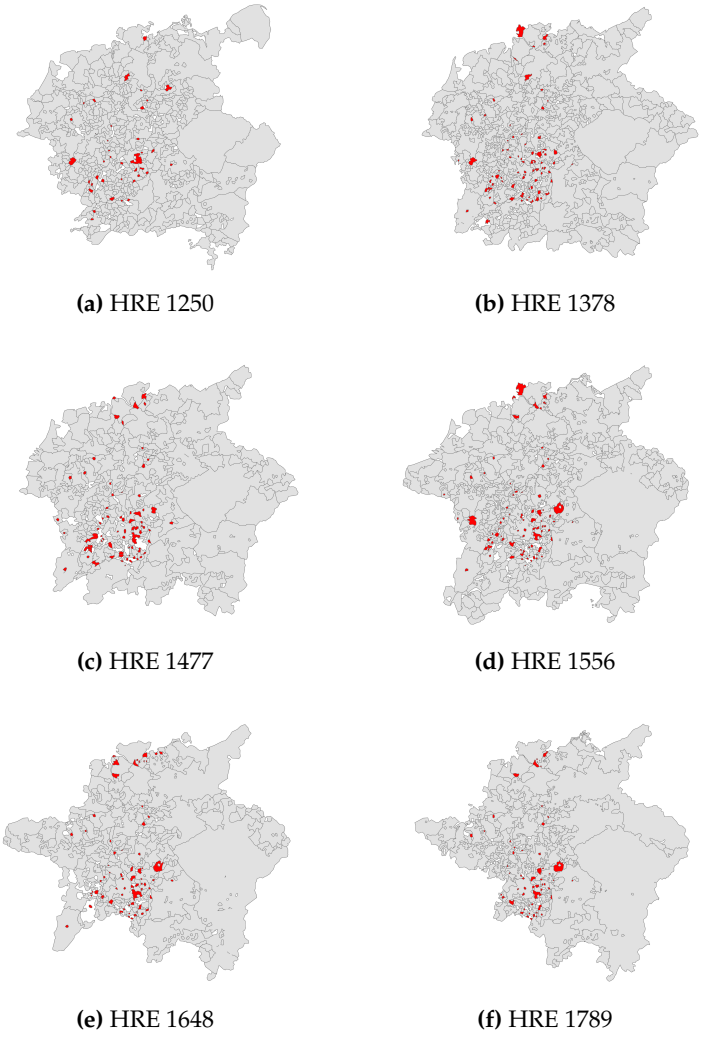
5. 1648, the end of the Thirty Years' War, concluded with the Peace of Westphalia. This landmark agreement reshaped the imperial political map: powerful states like Brandenburg and Hesse annexed smaller entities, while several imperial cities lost their autonomy—either becoming part of France or newly recognized Switzerland. The treaties also enshrined religious pluralism, effectively ending the Empire's confessional wars.

6. 1789, the start of the French Revolution, initiated a period of radical upheaval that

[46] Political fragmentation in the 13th century already exceeded that of the 12th century. This was largely due to the dissolution of the large stem duchies ("Stammesherzogtümer") following the power struggle between Henry the Lion, Duke of Saxony, and Emperor Frederick I. Intended to curb the power of regional dukes and consolidate imperial control, the fragmentation ultimately weakened central authority in the long run.

would ultimately dismantle the Holy Roman Empire. The ensuing Revolutionary and Napoleonic Wars catalyzed the most profound territorial and institutional transformations in Central Europe since the breakup of the stem duchies in the 12th century.

A.4.4 States in the Holy Roman Empire 1250–1789



(a) HRE 1250 **(b)** HRE 1378

(c) HRE 1477 **(d)** HRE 1556

(e) HRE 1648 **(f)** HRE 1789

Figure A.7: The Holy Roman Empire and its territorial states (gray) and city states (red) at our sampling years

A.4.5 Coding Challenges and Discussion of Difficult Cases

Typical challenges in data coding stemmed from inaccuracies in the name, classification, or omission of certain states. These issues arose primarily in the case of small entities for which historical information is sparse—most notably some Herrschaften (baronial or knightly domains)—as well as instances where multiple territories shared the same name (e.g., "Limburg"), or where specific imperial cities in the Alsace-Lorraine region were overlooked by Wolff.[47] In nearly all instances, we were able to resolve these inconsistencies through additional research, including consultation of local historical monographs.

A further complication involved determining when a state's independence began or ended. This was especially relevant in cases where a territory was divided among the sons of a deceased ruler. Wolff does not always accurately depict such partitions, which we corrected. Similarly, when dynasties died out or inheritance disputes arose, territories were often divided among competing claimants. In these situations, we evaluated whether one successor held a dominant share of rights or whether the area continued to function as an independent state in practice.

One illustrative case is the County of Sponheim. By the early 14th century, it had split into two separate parts: the Vordere (front) and Hintere (rear) Grafschaft. Upon the extinction of the ruling line of the Vordere Grafschaft, one-fifth passed to the Electoral Palatinate, while four-fifths went to the rulers of the Hintere Grafschaft. In 1437, the Margrave of Baden and the Count of Veldenz jointly inherited both parts and established a condominium. In 1559, the Palatinate-Simmern line (which had succeeded Veldenz) purchased the Palatinate's share of the Vordere Grafschaft and ceded half of the Hintere Grafschaft to the Duchy of Zweibrücken. This resulted in a complex arrangement: the Vordere Grafschaft was split three-fifths to Palatinate-Simmern and two-fifths to Baden, while the Hintere Grafschaft was jointly held by Baden and Zweibrücken. These territories were formally partitioned in 1707 (front) and 1776 (rear). Following the Congress of Vienna in 1815, the entire territory was absorbed into Prussia. For 1477 and 1555—when

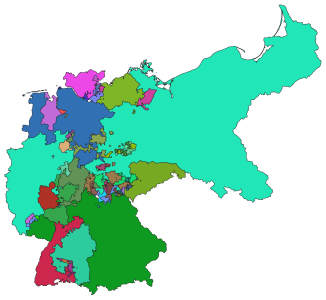
[47] One example is the case of Friedberg, which included both an imperial city and a small burgraviate around the local castle. Wolff only depicted one unified entity—marked as an imperial city—in his 1789 map. To correct this, we split the area between the two entities for the period 1250–1378. After 1477, when the imperial city lost independence and came under control of the burgraviate, we assigned the territory entirely to the latter, which continued to exist until 1806.

the county was governed as a condominium—we treat it as a single state. Wolff's 1556 map inaccurately disaggregates the area among several successor states, possibly reflecting conditions as of 1559 rather than 1556. For the years 1648 and 1789, we follow Wolff's division among the Electoral Palatinate, Baden(-Baden), and Zweibrücken.

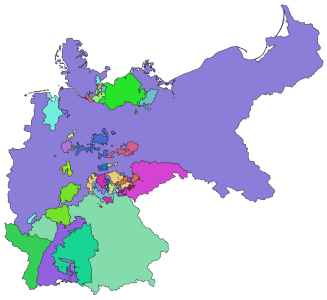
A related ambiguity concerns the de facto loss of independence of certain territories. Wolff and other historians sometimes depict prominent states (e.g., the Duchy of Berg) as reichsunmittelbar (immediate to the Empire) even when they were effectively ruled by other dynasties. For example, after the Duchy of Kleve-Jülich-Berg was divided following a succession conflict, Kleve and associated counties fell to Brandenburg, while Berg and Jülich passed to Pfalz-Neuburg. In such cases, we deviate from Wolff's depiction and assign the respective territories to their actual rulers.

City-states also presented difficulties in determining their true degree of independence. Some cities functioned with considerable autonomy despite never being formally recognized as imperial cities, while others held Reichsunmittelbarkeit in name only. To address these discrepancies, we consulted standard references on urban history such as Köbler (1988) and Keyser and Stoob (1939–1974), as well as studies specifically focused on imperial cities, including Cantoni (2012). We classified cities based on their de facto rather than de jure autonomy. This approach also applied to certain territories administered by the Emperor or other high nobles (e.g., electors) that lay outside their principal domains. One example is the Upper and Lower Lusatia regions (Oberlausitz and Niederlausitz), which were under the nominal control of such rulers but retained a high degree of autonomy. Following the logic adopted in parts of the literature, we classify the Lusatian territories as independent states.

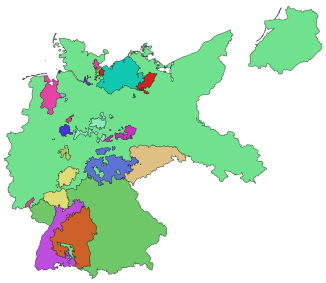
A.4.6 Maps on the German Territories and States after 1800



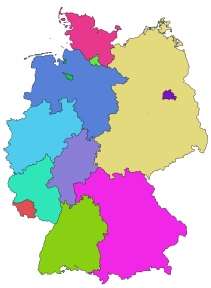
(a) The German Confederation in 1820



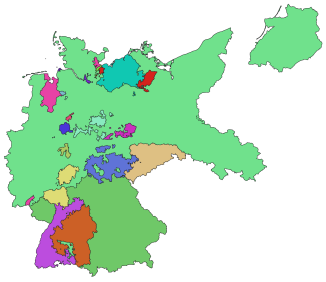
(b) States of the German Empire 1871



(c) States of the German Empire in 1919



(d) Federal States of the FRG and the GDR in 1948

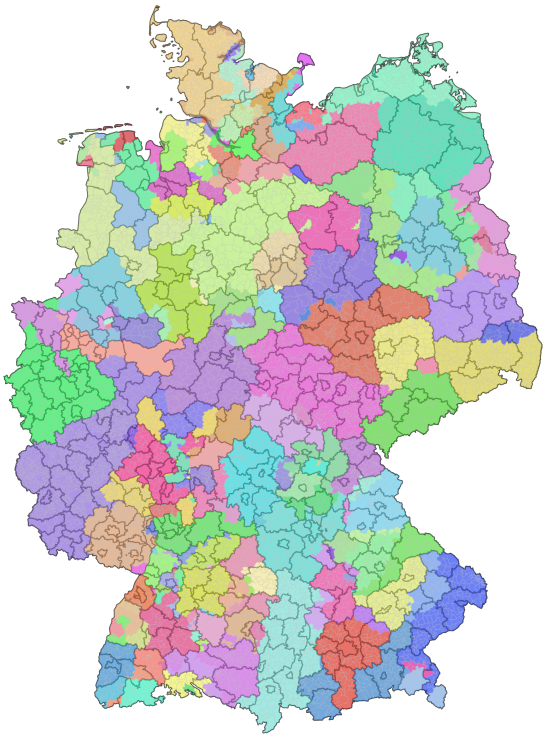


(e) States of the German Empire in 1925

(f) Federal States of the FRG in 1990

Figure A.8: States of the German Confederation, the German Empire, the FRG and the GDR

A.4.7 Map of the Distribution Areas of Regional Newspapers in Germany in 2022



Note: This figure shows the borders of contemporary German municipalities (white) and counties (black lines). The different colors indicate the different distribution areas of regional newspapers. In some areas several (up to five) regional newspapers are available. For these, the map indicates areas in which the same newspapers are available.

Figure A.9: Distribution Areas of Regional Newspapers in Germany, 2022

A.5 Descriptive Overview of the Data Sets

Table A.4: Descriptive Overview of the Municipality-Pair Commuting Data Set

Variable	Obs	Mean	Std. dev.	Min	Max
Place of Living Population 2019	120,068,509	7,578	50,068	0.000	3,669,491
ln(% Vehicles with Reintroduced UZs)	120,046,555	1.276	1.520	0.000	4.605
No. of Out-Commuters	120,507,589	0.152	15.10	0.000	23,500
Place of Living ln(Luminosity 2021)	120,046,555	0.0419	0.629	-0.976	3.285
ln(Distance to Workplace)	120,507,589	5.602	0.706	-2.181	6.792

Table A.5: Descriptive Overview of the County-Pair VC Investment Data Set

Variable	Obs	Mean	Std. dev.	Min	Max
ln(County Population)	156,400	11.943	0.628	10.432	14.118
Elevation	160,000	269.600	204.100	0.925	962.100
Investor	160,000	0.228	0.419	0.000	1.000
ln(Distance) in km	160,000	5.555	0.691	0	6.757
ln(% Vehicles with reintroduced UZs)	159,600	-0.341	2.429	-3.765	4.497
ln(Number of Investments	160,000	0.009	0.125	0.000	6.589
ln(Social Connectedness Index)	8.862	0.926	7.386	17.234	
Same Local Newspaper	160,000	0.048	0.213	0.000	1.000
Share Industry Buildings	156,400	0.017	0.0190	0.001	0.128

Table A.6: Descriptive Overview of the Municipality-Level Data Set on Regional Identity and Voting Behavior

Variable	Obs	Mean	Std. dev.	Min	Max
East Germany	11,264	0.236	0.425	0	1
Gemeindefrei	11,264	0.0482	0.214	0.000	1.000
Historical Battles	11,264	0.006	0.075	0.000	1.000
Kreisfrei	11,264	0 .009	0.097	0.000	1.000
Latitude	11,264	5635.959	215.752	5246.913	6097.555
ln(Distance to KZ)	11,264	2.623	0.744	-3.156	4.327
ln(Luminosity 2021)	10,981	0.042	0.628	-0.976	3.285
Latitude×Longitude	11,264	3190614	840499.5	1607068	5226483
ln(% Vehicles with reintroduced UZs)	11,264	1.258	1.520	0.000	4.605
ln(Historical Political Instability)	11,263	1.659	0.338	0.000	2.197
Longitude	11,264	565.241	144.079	284.1033	917.626
Population Loss 1987-2019	10,981	0.349	0.477	0	1
Share Catholics 2022	10,636	28.99	26.83	0.217	100
Share Far Left	11,052	0.057	0.06	0	0.291
Share Far Right	11,052	0.078	0.067	0	0.431
Share Left Parties	11,052	0.380	0.1	0.042	0.728
Share Right Parties	11,052	0.488	0.099	0.165	0.895
University	11,264	0.006	0.074	0	1
UZ reintroduced	11,264	0.678	0.467	0.000	1.000
Vote Share AfD	11,051	0.138	0.062	0	0.419
Vote Share CDU/CSU	11,052	0.410	0.113	0.150	0.841
Vote Share Die Linke	11,052	0.062	0.057	0	0.290
Vote Share FDP	11,052	0.08	0.026	0.005	0.331
Vote Share Grüne	11,052	0.06	0.026	0.004	0.253
Vote Share SPD	11,052	0.262	0.094	0.021	0.669

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