TI 2025-056/III
Tinbergen Institute Discussion Paper

Do shocks divide or unite: Evidence from the Netherlands

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Do shocks divide or unite: Evidence from the Netherlands

September 3, 2025

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Abstract: We study the possible increase of partisan polarization in the Netherlands over the period 1998–2023, in particular its relationship with the degree of urbanization, the so-called urban-rural divide. Using national election results at the municipal level and municipal characteristics, we show that urban-rural polarization has indeed increased. A novel aspect of our paper is the introduction of shocks as possible explanatory variables. The effect of a shock on polarization depends on the type of shock. An exterior shock tends to increase cohesion and lower polarization, but an interior shock leads to less cohesion and more polarization.

JEL Classification: C52, D72, D74, D83, Z13

Keywords: urban-rural divide, elections, shocks, geographic polarization, regional resentment

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1 Introduction

In these challenging times, our society seems to be more polarized than before. The ideas that people have about life, society, and politics are more extreme, there is less middle ground, and less willingness to compromise or see the other group's viewpoints. The increase in polarization is especially strong in the USA (Rodden, 2022; Brown and Mettler, 2024), partly because of the non-proportional 'first-past-the post' voting system. An important aspect of contemporary polarization is the degree of urbanization, the so-called urban-rural divide (Gimpel et al., 2020; Huijsmans and Rodden, 2025), and we shall use the term polarization to refer specifically to urban-rural polarization.

Urban-rural polarization can be measured in many ways. There can be a divide in political trust, cosmopolitanism, anti-immigration, EU skepticism, populist party support, among others. We focus on partisan polarization, which roughly captures the idea that urban residents vote for the left, while rural residents vote for the (more populist) right.

Although much of the research about polarization comes from the USA, there is also cross-national evidence (Taylor et al., 2024; Huijsmans and Rodden, 2025). One may wonder whether polarization is perhaps less prominent in countries with proportional representation. For this reason, among other more practical reasons, we shall consider the Netherlands, and ask ourselves how we can define and quantify urbanization and polarization, and then how polarization has developed in the Netherlands over the period 1998–2023.

In the Netherlands a pronounced rural–urban divide has emerged, which cannot be explained by geography alone. The divide is rooted in the intersection of economic insecurity, cultural value conflicts, and perceptions of political underrepresentation (Huijsmans et al., 2021; de Lange et al., 2023; Huijsmans, 2023). Drawing on these dynamics, populist radical right parties such as the PVV mobilize 'place resentment' and depict politics as a struggle between the societal core and its periphery (Harteveld et al., 2022), a strategy that has amplified existing divisions and contributed to the destabilization of democratic institutions.

We offer an alternative measure of urban-rural partisan polarization in a multi-party context (Huijsmans and Rodden, 2025). While our conclusions are at the national level, our data and our analysis is at the local level (municipalities). We conclude that polarization has indeed increased in the Netherlands, and we can quantify this increase within our framework.

Next, we ask *why* polarization has increased. What are the driving forces that polarize a society? We use national election results at the municipal level, municipal characteristics, and also some national indicators (inflation,

consumers' confidence) to explain, at least in part, the observed polarization.

A novel aspect of our paper is the introduction of shocks as possible explanatory variables, such as the global financial crisis in 2008/09 or the Covid-19 pandemic in 2020/21. We consider not only national shocks but also local or regional shocks which affect only a small number of municipalities. Did these shocks have any impact on the increased polarization or did perhaps the opposite happen? A big shock (like a war) may bring a country together rather than increase polarization.

Our paper focuses on short-term causes of polarization. Rodden (2022), Huijsmans (2023), and Brown and Mettler (2024), among others, look at long-term structural causes, both economic and non-economic, while Gimpel et al. (2020), Martin and Webster (2020), and Cantoni and Pons (2022) contrast location and composition effects. To the best of our knowledge, nobody has explored whether the rural-urban divide is sensitive to a sudden shock.

Shocks have also been discussed, from a different angle, in the psychology literature, when a family experiences a sudden death, a violent crime, or another tragedy. Does this bring the family closer together or does the opposite happen? That, of course, depends. It depends, inter alia, on pre-existing conditions and coping mechanisms (Schwab, 1998; Song et al., 2010). Is there any relation between what happens at the micro level (families) and what happens at the macro level (a country)?

Our analysis shows that polarization has increased in the Netherlands and that shocks do play a role. Moreover, the effect of a shock on polarization depends on the type of shock. We conclude (with some caution) that if the shock comes from outside (world financial crisis, Covid-19) then it tends to increase cohesion and lower polarization, but if it is an inside shock (an event only relevant in the Netherlands) then it leads to less cohesion and more polarization.

The remainder of the paper is organized as follows. In Section 2 we provide a brief account of the Dutch electoral system and the organization of the country in provinces and municipalities. In Sections 3 and 4 we discuss and define urbanization and polarization. We can then answer the question whether polarization had indeed increased—which it has. To analyze possible reasons we introduce the role of shocks in Section 5. Our statistical model is discussed in Section 6, and our results are presented in Section 7, followed by robustness checks in Section 8. Section 9 concludes. A full account of the data collection process and its challenges is provided in our online appendix.

2 National elections in the Netherlands

There are four levels of government in the Netherlands: local councils, provincial councils, the House of Representatives (*Tweede Kamer*), and the Senate (*Eerste Kamer*). We shall be concerned only with national elections, that is, elections for the 150 members of the House of Representatives. National elections take place every four years or earlier if the government collapses, which is quite common. To vote in the national elections, you must be a Dutch national and 18 years or older. The distribution of seats is determined by proportional representation. Typically, dozens of parties participate in the election, but only those parties with at least 1/150 of the number of valid votes are represented in the House.

Our analysis covers national elections for the House held between 1998 and 2023. During this period, nine elections took place. Four of these were regular elections (1998, 2002, 2017, 2021), while the remaining five (2003,

Table 1: House of Parliament in the Netherlands, seat distribution, 1998–2023[a]

Party	1998	2002	2003	2006	2010	2012	2017	2021	2023
VVD	38	24	28	22	31	41	33	34	24
D66	14	7	6	3	10	12	19	24	9
PVV	—	—	—	9	24	15	20	17	37
CDA	29	43	44	41	21	13	19	15	5
NSC	—	—	—	—	—	—	—	—	20
SP	5	9	9	25	15	15	14	9	5
PvdA	45	23	42	33	30	38	9	9	—
GroenLinks	11	10	8	7	10	4	14	8	—
GL/PvdA	—	—	—	—	—	—	—	—	25
FvD	—	—	—	—	—	—	2	8	3
PvdD	—	—	—	2	2	2	5	6	3
CU	—	4	3	6	5	5	5	5	3
SGP	3	2	2	2	2	3	3	3	3
Denk	—	—	—	—	—	—	3	3	3
JA21	—	—	—	—	—	—	—	3	1
Volt	—	—	—	—	—	—	—	3	2
50Plus	—	—	—	—	—	2	4	1	—
BIJ1	—	—	—	—	—	—	—	1	—
BBB	—	—	—	—	—	—	—	1	7
Lijst Fortuyn	—	26	8	—	—	—	—	—	—
Leefbaar NL	—	2	—	—	—	—	—	—	—
RPF	3	—	—	—	—	—	—	—	—
GPV	2	—	—	—	—	—	—	—	—
Total	150	150	150	150	150	150	150	150	150

[a] Source: Kiesraad

2006, 2010, 2012, 2023) were early elections following a collapse of government. The distribution of seats in the House is presented in Table 1, and it is clear that big swings can and do occur at Dutch national elections.

The Netherlands is divided into twelve provinces and a changing (decreasing) number of municipalities.[1] In 1998 there were 548 municipalities, 352 in 2021, and 342 in 2023.

Following Nemerever and Rogers (2021) who emphasize the importance of geographic measurement decisions (e.g., provinces versus districts versus municipalities versus census tracts), we choose municipalities as our units of study. To work at the provincial level is feasible but not fine enough, while a finer distinction into polling stations is not feasible. For our purpose it is convenient to work with a constant number of municipalities, and we have chosen 2021 as our reference year. Changes in municipal boundaries are well documented by Statistics Netherlands (*Centraal Bureau voor de Statistiek*, CBS), allowing us to construct a balanced panel of election results and other characteristics of the 352 municipalities over the period 1998–2023.

The data for each municipality include the number of valid votes for each participating party, the number of eligible voters, and the overall voter turnout. To focus the analysis on the main political trends, votes for very small parties that did not enter the House were excluded.

3 Urbanization

Since we focus on partisan polarization along the urban-rural dimension, our first task is to define what we mean by 'urban' and 'rural.' Let c_{it} denote the population density in municipality i at time t. We can order the municipalities in terms of their population densities:

$$c_{(1)t} < c_{(2)t} < \cdots < c_{(N)t}, \tag{1}$$

where N denotes the total number of municipalities, so that $c_{(1)t}$ represents the population density in the least populated rural municipality and $c_{(N)t}$ represents the population density in the most densely populated town (The Hague).

The most common procedure is to equate urbanization to population density: the higher is the population density, the more urbanized is the municipality. Following this idea, we could call the first N_1 municipalities of

[1] Outside Europe there are three special municipalities—Bonaire, Sint Eustatius, and Saba in the Caribbean—that are not part of any province. These three municipalities are excluded from our analysis.

the list in (1) 'rural' and the last N_2 'urban,' and write $i \in R$ if municipality i is rural and $i \in U$ if municipality i is urban. Huijsmans and Rodden (2025), for example, define N_1 to comprise 40% of the population in the least densely populated municipalities, and N_2 to comprise 40% of the population in the most densely populated municipalities, so that each municipality i is either in R, U, or neither.

This definition suffers from several weaknesses. First, the cut-off point of 40% is somewhat arbitrary. Second, no distinction is made between municipalities *within* each of the two groups R and U. These two weaknesses can be easily remedied by defining

$$c_{it}^* = \frac{c_{it} - \min_i c_{it}}{\max_i c_{it} - \min_i c_{it}} = \frac{c_{it} - c_{(1)t}}{c_{(N)t} - c_{(1)t}}, \tag{2}$$

which is a number between 0 and 1, and using c_{it}^* as a (continuous) measure of urbanization instead of the (dichotomous) groups R and U.

A third weakness of the definition used by Huijsmans and Rodden (2025) is the assumption urbanization = population density. There may be other factors that are relevant in the definition of urbanization and its effect on polarization. Recently, a number of authors have argued that what appears to be mainly a 'rural' phenomenon of radical-right support is at least in part anchored in something different, namely the tension between the center and the periphery of a country; see Gimpel et al. (2020), Cattaneo et al. (2021), de Lange et al. (2023), and Ziblatt et al. (2024), among others. Perhaps voters from peripheral geographic communities are more likely to vote for the radical right, because they feel left behind and resentful.

If we wish to include 'distance to the center' (in addition to population density) in our definition of urbanization, we need to decide how to measure this distance. Ziblatt et al. (2024) use dialect (nonstandard language) as a measure of periphery, while de Lange et al. (2023) use the distance in kilometers to the center of power. We follow de Lange et al. (2023) and measure periphery by the distance to the center of power, in our case The Hague. (Amsterdam is the capital of the Netherlands, but the government is in The Hague.) More precisely, we let d_{1i} denote the geographical distance between the center of municipality i to the political center in The Hague.[2] In addition, we consider a second distance measure d_{2i}, which denotes the distance to the nearest 'hub,' where we define a hub to be a municipality with more than 150,000 inhabitants. There are 18 hubs among the 352

[2]We also calculated the travel time by car, which is more complicated because it depends on t. Our results are not sensitive to this alternative measure, so we employ the easier method.

municipalities of which Amsterdam is the largest with just under one million inhabitants. Since $\min_i d_{1i} = \min_i d_{2i} = 0$, we scale the distance measures as

$$d^*_{1i} = 1 - \frac{d_{1i}}{\max_i d_{1i}}, \qquad d^*_{2i} = 1 - \frac{d_{2i}}{\max_i d_{2i}}, \tag{3}$$

so that the smaller the distance to The Hague, the larger is d^*_{1i}, and the smaller the distance to the nearest hub, the larger is d^*_{2i}. Our combined distance measure is then

$$d^*_i = \lambda d^*_{1i} + (1-\lambda) d^*_{2i} \qquad (0 \leq \lambda \leq 1). \tag{4}$$

Based on population density and distance we arrive at the following definition of the degree of urbanization:

$$u_{it} = \frac{(1-\alpha) c^*_{it} + \alpha d^*_i}{(1-\alpha) \sum_i c^*_{it} + \alpha \sum_i d^*_i} \qquad (0 \leq \alpha \leq 1), \tag{5}$$

which, again, is a number between 0 and 1. The weights α and λ need to be determined empirically.

4 Polarization

Given our various definitions of urbanization, we now discuss associated definitions of partisan polarization, focusing specifically on the urban-rural dimension. Unlike urbanization, the concept of polarization involves voting behavior, and we let v_{ipt} denote the number of votes in municipality i on party p at time t, and $v_{pt} = \sum_i v_{ipt}$ the total number of votes on party p at time t over all municipalities. We measure urban-rural partisan polarization by the urban-rural divide, which captures how strongly a party's support is related to the degree of urbanization of municipalities.

4.1 Dichotomous approach (national)

Following Huijsmans and Rodden (2025), let U_{pt} denote the percentage of the votes on party p at time t over all urban municipalities, and let R_{pt} denote the percentage of the votes on party p at time t over all rural municipalities, so that

$$U_{pt} = \frac{\sum_{i \in U} v_{ipt}}{\sum_p \sum_{i \in U} v_{ipt}}, \qquad R_{pt} = \frac{\sum_{i \in R} v_{ipt}}{\sum_p \sum_{i \in R} v_{ipt}}. \tag{6}$$

The urban-rural divide in the party's support base is then defined by Huijsmans and Rodden (2025) as

$$D_{pt} = 2 \left(\frac{U_{pt}}{U_{pt} + R_{pt}} - \frac{1}{2} \right), \tag{7}$$

which is a number between -1 and 1, and the national urban-rural divide as

$$D_t = \frac{\sum_p v_{pt}|D_{pt}|}{\sum_p v_{pt}}. \tag{8}$$

A small value of D_t (close to 0) indicates a small urban-rural gap, while a large value of D_t (close to 1) indicates a large gap.

4.2 Continuous approach (national)

An alternative (continuous) approach is based on the degree of urbanization u_{it} as defined in (5), and the importance of party p in municipality i, measured by the percentage of votes on party p relative to the total number of votes in municipality i (the party's support base in municipality i):

$$v^*_{ipt} = \frac{v_{ipt}}{\sum_p v_{ipt}}. \tag{9}$$

Not all municipalities have the same size. We measure the relative size of a municipality by the number of votes in that municipality relative to the national number of votes:

$$w_{it} = \frac{\sum_p v_{ipt}}{\sum_i \sum_p v_{ipt}} = \frac{\sum_p v_{ipt}}{\sum_p v_{pt}}. \tag{10}$$

The weights w_{it} are used to take weighted averages of u_{it} and v^*_{ipt}, leading to average urbanization

$$\bar{u}_t = \sum_i w_{it} u_{it}, \tag{11}$$

and the relative importance of party p at the national level

$$\bar{v}^*_{pt} = \sum_i w_{it} v^*_{ipt} = \frac{v_{pt}}{\sum_p v_{pt}}. \tag{12}$$

The importance of party p in municipality i (measured by v^*_{ipt}) is correlated with the degree of urbanization (measured by u_{it}), and we interpret the (weighted) correlation between u_{it} and v^*_{ipt} as the urban-rural divide in the party's support base:

$$D_{pt} = \frac{\sum_i w_{it}(u_{it} - \bar{u}_t)(v^*_{ipt} - \bar{v}^*_{pt})}{\sqrt{\sum_i w_{it}(u_{it} - \bar{u}_t)^2}\sqrt{\sum_i w_{it}(v^*_{ipt} - \bar{v}^*_{pt})^2}}, \tag{13}$$

which is again a number between -1 and 1, and should be contrasted to the expression in (7).

As in (8), we define the national urban-rural divide as the average of the absolute correlations, weighted by the vote share of party p:

$$D_t = \sum_p \left(\frac{v_{pt}}{\sum_p v_{pt}} \right) |D_{pt}| = \sum_p \bar{v}^*_{pt} |D_{pt}|. \tag{14}$$

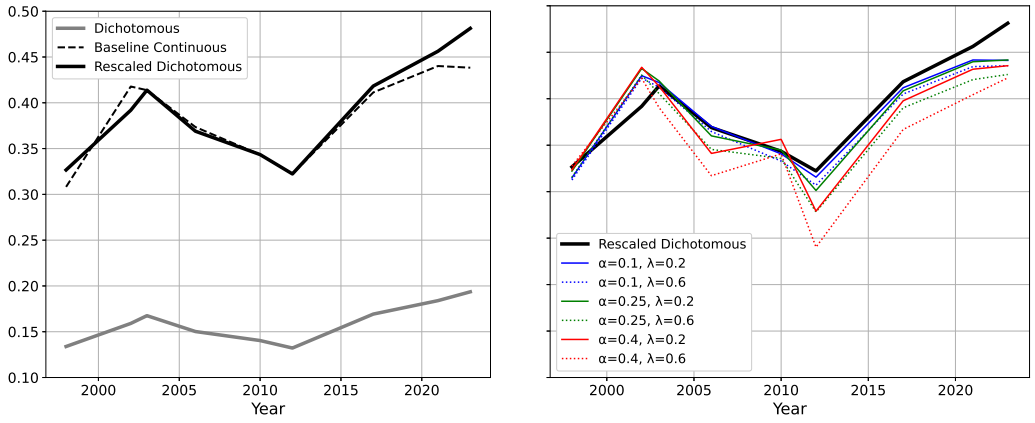

Figure 1: Urban-rural divide in the Netherlands, 1998–2023

Figure 1 presents the national urban-rural divide scores D_t across elections in the Netherlands. The left panel displays the continuous (dashed black) line based on (14), where urbanization = population density and α is set equal to 0, and the corresponding dichotomous (solid grey) line based on (8). To facilitate comparison between the two lines, we also present a rescaled version of the dichotomous line (solid black), where we perform a linear transformation based on the dichotomous scores in 2003 and 2012.

A high value of D_t indicates that the parties' voter bases are more geographically polarized: some parties are increasingly supported in either urban or rural areas. The dichotomous and continuous lines are highly correlated, but they also show some interesting differences. While the dichotomous measure shows a peak in 2003, the continuous measure indicates an earlier peak in 2002. Also, the dichotomous measure suggests a continued rise in polarization through 2023, while the continuous measure points to a plateau. Since the continuous measure uses the full range of urbanization values across municipalities rather than relying on dichotomous groupings, we place more value on the continuous measure as it captures more nuanced shifts in polarization.

The right panel of Figure 1 displays the rescaled dichotomous measure (black line) alongside a range of continuous specifications, varying the urbanization measure by combining population density and peripherality through different values of $\alpha = 0.10, 0.25, 0.40$, and $\lambda = 0.2, 0.6$. The displayed parameter values reflect trade-offs between centrality and density.

All specifications have a similar overall trend and show a peak at the election of 2002. For $\alpha = 0.4$ the general decline after 2002 is interrupted by the 2010 elections, a shift not reflected in other specifications. The more weight we give to distance relative to population density (higher value of α) the lower is the value of D_t, in general but not always. Vote shares thus tend to be less correlated with urbanization when we include distance in the definition of urbanization. And the more weight we give to hubs (lower value of λ) the higher are the party correlations. However, these relationships differ across parties. As shown in the online appendix, most parties experience only modest changes in the correlation, while for some parties—most notably the VVD—correlation typically increases with both α and λ, which may explain the rise in national polarization in 2010 under the specification with $\alpha = 0.4$, when the VVD became the largest party. These results highlight the importance of evaluating a range of parameter settings to capture variation in urban-rural polarization.

4.3 Continuous approach (local)

We defined the urban-rural divide in the support system of party p at the national level by D_{pt} in (13), and then the national urban-rural divide by D_t in (14). Similarly, we now define the local (municipal) urban-rural divide as the average of the absolute correlations, weighted by the vote share of party p in municipality i:

$$D^*_{it} = \sum_p \left(\frac{v_{ipt}}{\sum_p v_{ipt}} \right) |D_p| = \sum_p v^*_{ipt} |D_{pt}|. \tag{15}$$

A high local divide score D^*_{it} indicates that voters in municipality i mainly support parties that are nationally associated with either urban or rural areas. It reflects how strongly the national urban-rural divide is expressed in the local vote. Even if a municipality is not very urban or rural itself, its score will be high if voters favor parties with a clear urban or rural profile at the national level.

Since our analysis will be at the local level, it is the local urban-rural divide which we wish to explain and which will serve as our dependent variable.

Notice that $D_t^* = \sum_i w_{it} D_{it}^* = D_t$, because

$$D_t^* = \sum_i w_{it} D_{it}^* = \sum_i \frac{\sum_p v_{ipt}}{\sum_i \sum_p v_{ipt}} \sum_p |D_{pt}| \frac{v_{ipt}}{\sum_p v_{ipt}} = \sum_i \frac{\sum_p |D_{pt}| v_{ipt}}{\sum_i \sum_p v_{ipt}}$$
$$= \sum_p \sum_i \frac{|D_{pt}| v_{ipt}}{\sum_i \sum_p v_{ipt}} = \sum_p \frac{\sum_i v_{ipt}}{\sum_i \sum_p v_{ipt}} |D_{pt}| = \frac{\sum_p v_{pt} |D_{pt}|}{\sum_p v_{pt}} = D_t. \quad (16)$$

The national divide is the weighted average of local divides. This means that national divide patterns are fully determined by local-level changes. Increases in the national divide arise when more municipalities show stronger local urban-rural divide.

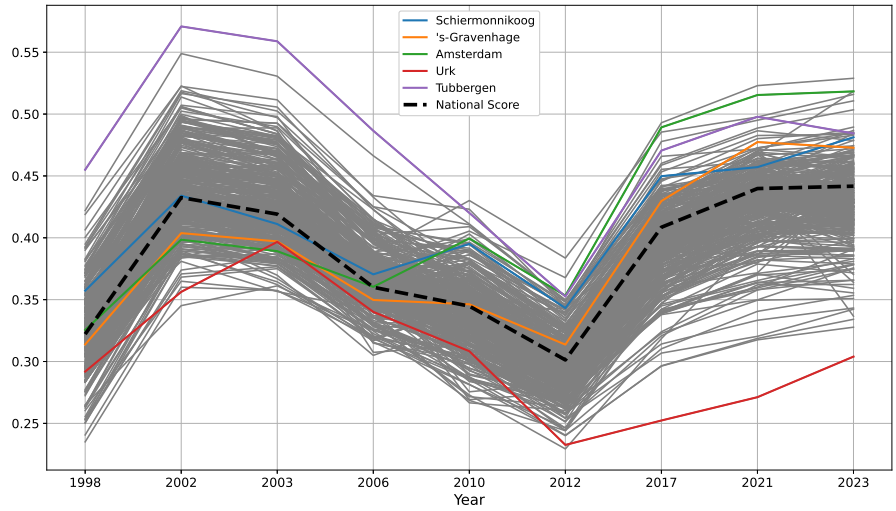

Figure 2: Local urban-rural divide in the Netherlands, 1998–2023

Figure 2 displays the local divide scores for all municipalities across elections in the Netherlands, with five selected municipalities highlighted in color. The parameter values are set to $\alpha = 0.25$ and $\lambda = 0.2$. The national continuous divide is shown as a dashed black line. The most densely populated municipality in the sample (The Hague) and the least densely populated (Schiermonnikoog) show relatively similar polarization dynamics throughout the period. Amsterdam remains below the national level until the 2010 election, indicating stronger recent alignment with parties that have either an urban or rural profile. Some municipalities, such as Urk and Tubbergen, follow distinct trajectories that deviate from most municipality patterns.

5 Shocks

Shocks represent sudden and significant events or changes that disrupt established social, economic, or political patterns, potentially triggering shifts in voting behavior and party support. They can heighten the salience of cultural identity relative to economic concerns, thereby intensifying polarization (Bonomi et al., 2021; Bornschier et al., 2021). Since individuals with similar cultural preferences tend to cluster geographically (Maxwell, 2020), this polarization often aligns with spatial divides (Cantoni and Pons, 2022), potentially leading to an increase in the urban-rural divide. Accounting for these shocks thus allows for a more nuanced analysis of polarization.

We distinguish between national shocks and regional (local) shocks. At the national level we selected sudden shocks that were generally recognized as events with disruptive economic or social consequences affecting the whole population. Such events include economic crises, pandemics, wars, and assassinations, all of which increase uncertainty and have a likely electoral impact. The four most important national shocks are:

N1 The global financial crisis (2008–2009) had a big impact on the Dutch economy, leading to a contraction of GDP, a rise in unemployment, and cuts in public spending. The Dutch economy contracted by over 4% in 2009, and the shock lowered confidence in financial institutions and increased economic insecurity.

N2 The Covid-19 pandemic (2020–2021) induced severe health implications and restrictions on social and economic activity. In January 2021, the introduction of a nationwide curfew triggered riots in urban areas such as Eindhoven and Rotterdam.

N3 The Russian invasion of Ukraine (2022–2023) led to sharp increases in energy prices throughout the European Union leading to increased inflation in the Netherlands.

N4 The assassination of Pim Fortuyn (2002) was not an economic shock, but the murder of this right-wing populist just before the 2002 general election had a big impact on Dutch politics. Fortuyn's sudden death generated widespread public and media attention and contributed to the LPF's electoral success that year.

Brexit is excluded from this list, because it is difficult to determine the beginning of this shock, that is, when the effects of Brexit began to influence polarization in the Netherlands. The process took several years, from the 2016 referendum, through negotiations, to its eventual implementation. Moreover,

the impact of Brexit on the Dutch economy appears to be relatively small.

At the local level we selected shocks that had a strong impact on a specific municipality or region and triggered a public debate about state responsibility and institutional neglect. We focussed on natural disasters, industrial decline, and external impact of policies, each of which is likely to generate frustration or distrust at the local level. The most important local shocks are:

L1 The gas extraction crisis in the province of Groningen (2012–2023) followed from an increasing number of earthquakes resulting from decades of natural gas extraction. The 2012 quake in the village of Huizinge registered a magnitude of 3.6 and marked a turning point in public awareness. A 2023 parliamentary inquiry concluded that governmental institutions had systematically neglected the safety and well-being of local residents in favor of national economic interests, leading to a decrease of institutional trust in the region.

L2 Excessive rainfall in the province of Limburg (July 2021) led to severe flooding, particularly in the municipality of Valkenburg aan de Geul. Thousands of households were affected, with estimated damages exceeding €400 million. The floods received national attention.

L3 The municipality of Eindhoven faced industrial decline (1990s) with the bankruptcy of DAF Car and large-scale layoffs at Philips, two of the city's major employers, leading to a spike in unemployment.

L4 The closure of the gunpowder factory Muiden Chemie in the municipality of Muiden (2001) followed years of safety violations and public concern. The factory was shut down after renewed fire hazards. The incident not only had economic effects due to job losses but also raised questions about local environmental regulations and the role of the municipality in ensuring public safety.

(3) The selection of the municipalities for the regional shocks in Groningen and Limburg (L1 and L2) is discussed in the online appendix.

6 Econometric model

To investigate the impact of socio-economic variables and shocks on polarization we need a model and a statistical context. Our dependent variable is the local (municipal) urban-rural divide, defined in (15) and denoted by

D^*_{it}, and our explanatory variables are characteristics of the municipality x_{it} (including distance to The Hague and nearest hub, and population density), national characteristics x^*_t, local and national shocks s_{it}, and the influence of neighboring municipalities.

Apart from detailed election results per municipality, our data set contains information on the following municipal variables:

- location: geographical location, distance to other municipalities, neighboring municipalities,
- population: population size, population density,
- gender: percentage of women,
- age: percentage youths, percentage aged 65 and over, and
- prosperity: average sale price of houses.

In addition to municipal data, we also employ three characteristics at the national level, namely inflation (consumer price index), consumers' confidence in the Dutch economy, and economic growth.

Neighboring municipalities or municipalities that are close to each other geographically are likely to influence each other. We wish to take this effect into account and define A_i to be the set of municipalities that are 'close' (but not equal) to i, and

$$\bar{D}^*_{it} = \frac{1}{\nu_{it}} \sum_{j \in A_i} w_{jt} D^*_{jt}, \qquad \nu_{it} = \sum_{j \in A_i} w_{jt} \tag{17}$$

as the average urban-rural divide in the neighborhood of municipality i, where we have taken the size of municipality j into account by using the weights w_{jt}. If $j \in A_i$ then municipalities i and j are assumed to be correlated.

We consider K shocks (labeled $k = 1, \ldots, K$) and we define indicators

$$s^{(k)}_{it} = \begin{cases} 1 & \text{if shock } k \text{ affects municipality } i, \\ 0 & \text{if shock } k \text{ does not affect municipality } i, \end{cases} \tag{18}$$

so that the $K \times 1$ vector

$$s_{it} = \begin{pmatrix} s^{(1)}_{it} \\ s^{(2)}_{it} \\ \vdots \\ s^{(K)}_{it} \end{pmatrix} \tag{19}$$

summarizes all shocks that are relevant in municipality i at time t. Note that for national shocks $s_{it}^{(k)} = 1$ for all municipalities i.

Given these preliminary definitions we now write our linear model as

$$D_{it}^* = \beta_0 + x_{it}'\beta_1 + x_t^{*\prime}\beta_2 + s_{it}'\beta_3 + \rho\bar{D}_{it}^* + \epsilon_{it}^*. \tag{20}$$

We assume that the error term ϵ_{it}^* has mean zero, but its variance will not be constant because municipalities differ in size. Taking the size difference into account, we assume that $\text{var}(\epsilon_{it}^*) = \sigma^2/w_{it}^2$, so that $\text{var}(w_{it}\epsilon_{it}^*) = \sigma^2$. As a result, we rewrite model (20) as

$$y_{it} = \beta_0 w_{it} + (w_{it}x_{it})'\beta_1 + (w_{it}x_t^*)'\beta_2 + (w_{it}s_{it})'\beta_3 + \rho w_{it}\bar{D}_{it}^* + \epsilon_{it}, \tag{21}$$

where $y_{it} = w_{it}D_{it}^*$ and $\epsilon_{it} = w_{it}\epsilon_{it}^*$.

One may argue that we should take the possibility into account that there are correlations over municipalities and/or time, perhaps assuming a three-error component structure $\epsilon_{it} = u_i + v_t + \zeta_{it}$. This would be possible, but we have decided not to follow this path for three reasons. First, correlation between municipalities has already been accounted for in the setup of the model. Second, correlations over time certainly exist, but they don't explain much and even their direction is not clear. One typically assumes that people are hesitant to change their minds and are likely to stick with old beliefs, but Dutch election results don't seem to justify this assumption. The election results (especially the more recent ones) are highly volatile, so that correlation over time is not obvious. Third, following Einstein's dictum 'As simple as possible, but not simpler,' we aim for the simplest model that is justified by our theory and our data.

7 Estimation results

Before we can estimate our model parameters we need to set the hyper-parameters α and λ by balancing population density and distance to the political and economic center. We set these parameters at $\alpha = 0.25$ and $\lambda = 0.2$, because these values provide a plausible weighting between the density component c_{it}^* and the combined distance measure d_i^*. We shall assess the robustness of these choices in Section 8. Next, we compute the local polarization measure D_{it}^* for each municipality and each year, as well as average polarization in neighboring municipalities $\bar{D}_{it}^*$.

Given our model introduced in Section 6 and measuring urbanization as defined in Section 4.2, we can now estimate the parameters in our model. We estimate the unknown parameters from model (21) by weighted-average least

squares (WALS), a model-averaging method allowing us to take into account both the noise caused by model selection and the noise caused by estimation; see Magnus and De Luca (2016), De Luca et al. (2025), and De Luca and Magnus (2025). An important aspect of WALS is the distinction between focus and auxiliary regressors. A focus regressor is always in the model, irrespective of the observed t-value—it is a variable which either belongs in the model on theoretical or common-sense grounds or it is a variable whose impact on the dependent variable we wish to measure. An auxiliary variable, on the other hand, may or may not be in the model—its role is to improve the estimation of the focus parameters.

In our case, the focus variables include the four national shocks (N1–N4), the average polarization in the neighborhood, and the variables that underlie the urbanization (population density, the distance to The Hague, and the distance to the nearest hub). The auxiliary variables include the four local shocks (L1–L4), and municipality- and national-level socio-economic variables.

Table 2 presents the estimated coefficients, standard errors, and 95% confidence intervals, based on 3168 observations. Although estimation takes place at the municipal level, allowing us to take full advantage of local characteristics, we can aggregate model (21) to

$$\begin{aligned} D_t^* = \sum_i w_{it} D_{it}^* = \beta_0 + \left(\sum_i w_{it} x_{it}\right)' \beta_1 + x_t^{*\prime} \beta_2 \\ + \left(\sum_i w_{it} s_{it}\right)' \beta_3 + \rho \sum_i w_{it} \bar{D}_{it}^* + \epsilon_t^*, \end{aligned} \tag{22}$$

where $\epsilon_t^* = \sum_i w_{it} \epsilon_{it}^*$, which allows us to interpret our parameters at the national level.

The direction and magnitude of each parameter reveal how different events and conditions affect the urban-rural divide. National shocks with an *external* origin—the global financial crisis (N1), Covid-19 (N2), and the invasion of Ukraine (N3)—seem to be associated with a *lower* degree of polarization (and hence a higher degree of national cohesion). Apparently, voters' preferences in urban and rural areas become closer when faced with external economic, health, or security threats. In particular, the large negative coefficient for N3 (Ukraine) emphasizes the sociological impact of this event. In contrast, the assassination of Pim Fortuyn (N4) is associated with a *higher* degree of polarization, suggesting that *internal* political shocks can heighten the urban-rural divide in party support.

Geographical context also matters. The positive neighborhood divide pa-

Table 2: Regression results, focus and auxiliary variables

Variable	Coefficient	SE	CI_{lower}	CI_{upper}
Focus				
Constant	0.0000	0.0000	−0.0000	0.0000
Financial crisis (N1)	−0.1448	0.0072	−0.1635	−0.1332
Covid-19 (N2)	−0.0088	0.0067	−0.0251	0.0050
Invasion Ukraine (N3)	−0.2583	0.0114	−0.2874	−0.2404
Murder Fortuyn (N4)	0.1460	0.0060	0.1370	0.1607
Population density	0.0000	0.0000	0.0000	0.0000
Distance to The Hague	0.0001	0.0000	0.0001	0.0001
Distance to hub	0.0002	0.0000	0.0002	0.0003
Neighborhood divide ($\hat{\rho}$)	0.4181	0.0212	0.3658	0.4560
Auxiliary				
Earthquakes Groningen (L1)	0.0046	0.0072	−0.0159	0.0174
Flooding Limburg (L2)	0.0054	0.0069	−0.0128	0.0228
Industrial decline Eindhoven (L3)	0.0136	0.0057	−0.0031	0.0271
Closure Muiden (L4)	0.0113	0.0172	−0.0350	0.0601
Turnout	0.0005	0.0001	0.0002	0.0008
Population size	0.0000	0.0000	0.0000	0.0000
Share women	−0.0036	0.0003	−0.0043	−0.0031
Share youth	0.0019	0.0002	0.0015	0.0025
Share elderly	−0.0036	0.0002	−0.0041	−0.0033
Avg. house price	0.0000	0.0000	0.0000	0.0000
Inflation	−0.1547	0.0063	−0.1708	−0.1448
Consumer confidence	0.0219	0.0009	0.0204	0.0243
Economic growth	−0.1232	0.0042	−0.1334	−0.1175
Economic situation last year	−0.0100	0.0004	−0.0113	−0.0093

rameter ($\hat{\rho} = 0.42$) reflects that polarization is not randomly distributed, but clustered. Municipalities with polarized neighbors tend to be more polarized themselves. As expected, a greater distance from political and economic centers (The Hague and nearby hubs), is associated with more polarization.

Table 3: Marginal effects of selected continuous variables on polarization

Variable	IQR	Coefficient	Marg. effect
Share women	(49.78, 50.75)	−0.0036	−0.0034
Share youth	(10.70, 12.10)	0.0019	0.0027
Share elderly	(13.80, 20.50)	−0.0036	−0.0244
Population density	(238, 1175)	0.0000	0.0029
Avg. house price	(197, 313)	0.0000	0.0160
Distance to The Hague	(58.34, 139.1)	0.0001	0.0079
Distance to hub	(11.86, 34.52)	0.0002	0.0051

Although the estimated coefficients are meaningful, they depend on the units of measurement, and hence the question whether an effect is large or small can not be immediately answered. To better understand the geographic and demographic effects, Table 3 translates the raw coefficients into marginal effects for realistic changes in each variable. By considering the interquartile range (IQR), we can calculate the shift from the 25th to the 75th quartile and express our results in terms of predicted changes in polarization that can be compared across variables and do not depend on the units of measurement. For example, we can compare a municipality with many young people with a municipality with mostly elderly people by raising the share of the elderly from 13.8% to 20.5%. This shift is associated with a decrease in polarization of about 0.02, and hence suggests that older populations are less inclined to extremism. In contrast, an increase in the youth share increases polarization, but only by about 0.003, so younger voters tend to gravitate (slightly) towards parties with pronounced spatial profiles.

Municipalities with higher average house prices show greater divides, pointing to the role of socio-economic clustering in shaping political differences. Other continuous variables have smaller effects. A greater distance from The Hague or a major hub modestly increases polarization.

Macroeconomic conditions also play a role in shaping the divide. Higher inflation and stronger GDP growth are associated with lower polarization, possibly because good or bad economic performance is more important (at least in the short term) than spatial differences in political preferences. Conversely, higher consumer confidence correlates with greater divides, suggest-

ing that in more optimistic times, voters return to issues and identities that differentiate urban from rural areas.

While the four national shocks affect polarization, the four local shocks (L1–L4) do not, at least at the national level. It may be (and it seems likely) that local shocks affect the directly involved local communities, but the estimated parameters and the available number of observations are too small to draw any conclusions on the local effects of local shocks.

8 Robustness

Naturally, the question arises how robust our results are against various types of specification, and we shall discuss three aspects of this important question: We may deviate from the linear model by including interaction terms, we may consider alternative values of the hyperparameters α and λ, and we may think about other methods of estimation. We shall discuss each of these aspects in turn.

8.1 Interaction terms

In regression, an interaction effect exists when the effect of an independent variable on the dependent variable changes, depending on the value(s) of one or more other independent variables. To examine whether the effect of shocks on polarization depends on specific socio-economic or spatial characteristics, we extend model (21) with a set of interaction terms. The inclusion of these terms allows us to capture possible heterogeneous effects of shocks that may be amplified or dampened by local conditions. We shall consider seven interactions that we consider the most plausible combinations of shocks and municipality characteristics: four interactions between national shocks and socio-economic characteristics, one between a national shock and a spatial context, and two between local shocks and spatial or socio-economic variables.

Regarding the national shocks, we include the interaction between the financial crisis and population density to explore whether the economic downturn had a larger divide effect on these municipalities. The Covid-19 pandemic is interacted with the share of elderly residents, as older populations faced higher health risks and may have reacted differently politically. We also interact the energy price shock caused by the invasion of Ukraine with the average house price, since households in low-cost areas may be more vulnerable to increases in energy costs. The murder of Pim Fortuyn is interacted with distance to the closest hub, since there could be a peripheral aspect to

Table 4: Regression results, focus and auxiliary interaction terms

Variable	Coefficient	SE	CI_{lower}	CI_{upper}
Focus				
Constant	0.0000	0.0000	−0.0000	0.0000
Financial crisis (N1)	−0.1862	0.0083	−0.2098	−0.1731
Covid-19 (N2)	−0.0105	0.0092	−0.0281	0.0097
Invasion Ukraine (N3)	−0.2478	0.0127	−0.2835	−0.2285
Murder Fortuyn (N4)	0.1453	0.0060	0.1348	0.1599
Population density	0.0000	0.0000	0.0000	0.0000
Distance to The Hague	0.0001	0.0000	0.0001	0.0001
Distance to hub	0.0002	0.0000	0.0001	0.0002
Neighborhood divide ($\hat{\rho}$)	0.3819	0.0218	0.3261	0.4172
Auxiliary interaction terms				
N1 × Population density	0.0000	0.0000	0.0000	0.0000
N2 × Share elderly	−0.0008	0.0003	−0.0016	−0.0003
N3 × Avg. house price	0.0000	0.0000	0.0000	0.0000
N4 × Distance to hub	0.0006	0.0001	0.0005	0.0008
N1 × Distance to The Hague	0.0002	0.0000	0.0001	0.0002
L1 × Population density	−0.0000	0.0000	−0.0002	0.0001
L2 × Avg. house price	0.0000	0.0000	−0.0000	0.0000

this shock.

For the local shocks, we interact the Groningen earthquakes with population density, in order to assess whether local divides generated by the crisis are linked to denser municipalities. For the Limburg floods, we interact the shock with average house prices, as flood damages are plausibly larger in municipalities with higher-value housing.

In Table 4 we report the results for the focus variables and the interaction terms. The auxiliary regressors listed in Table 2 are included in our WALS estimation procedure, but the estimates are not reported in Table 4. It is clear from the table that the importance of the interaction terms is small, that their effect on the focus variables is negligible, and hence that the linearity hypothesis is a reasonable approximation in our case.

8.2 Urbanization hyperparameters

To ensure that our findings are not sensitive to a particular specification of urbanization, we conduct a robustness analysis by varying the parameters α and λ, which determine the urbanization measure defined in (5). The parameter λ defines the relative importance of distance to the political center in The Hague versus distance to the nearest large urban hub, while α sets the weight between the distance measure and the population density. Values

of λ between 0.2 and 0.6 reflect plausible trade-offs between political and economic centrality, and values of α between 0.1 and 0.4 ensure a realistic balance between the distance measure and the population density.

Table 5: Robustness of WALS estimates with respect to hyperparameters α and λ

Variable	$\alpha = 0.25$	$\alpha = 0.10$		$\alpha = 0.25$	$\alpha = 0.40$	
	$\lambda = 0.2$	$\lambda = 0.2$	$\lambda = 0.6$	$\lambda = 0.6$	$\lambda = 0.2$	$\lambda = 0.6$
Constant	0.000	0.000	0.000	0.000	−0.000	0.000
Financial crisis (N1)	−0.145	0.008	0.008	0.007	0.001	0.027
Covid-19 (N2)	−0.009	0.009	0.006	−0.008	−0.008	−0.018
Invasion Ukraine (N3)	−0.258	0.019	0.022	0.012	−0.015	0.041
Murder Fortuyn (N4)	0.146	−0.011	−0.011	−0.004	0.009	−0.017
Population density	0.000	−0.000	−0.000	−0.000	0.000	−0.000
Distance to The Hague	0.000	0.000	0.000	−0.000	−0.000	−0.000
Distance to hub	0.000	−0.000	−0.000	0.000	0.000	0.000
Neighborhood div. ($\hat{\rho}$)	0.418	0.023	0.023	0.009	−0.014	0.007

Table 5 reports the WALS estimates for the focus variables across a range of (α, λ)-combinations, relative to the baseline specification $\alpha = 0.25$ and $\lambda = 0.2$ discussed in the previous section. The numbers in the right panel represent *deviations* from the baseline case, and we see that all deviations are small for all focus variables, indicating that our results are not sensitive to the precise weighting of population density versus distance-based peripherality, nor to the trade-off between political and hub distance. For example, the effect of the invasion of Ukraine (N3) remains large and negative in all specifications, which reinforces the conclusion that this national shock had a unifying effect, independent of how urban-rural structure is defined.

These results show that our conclusions are robust to reasonable alternative definitions of urbanization. A more extensive robustness analysis is supplied in the online appendix, and confirms these findings.

8.3 Difference-in-differences

A possible alternative method of estimation would have been difference-in-differences (DiD), but this method is not feasible in our setting. The DiD framework typically requires treated and untreated groups and the parallel trends assumption to identify causal effects. In our setting, however, multiple nationwide shocks affect all municipalities at the same time, so that there is no untreated control group to compare against. This makes it impossible to isolate a counterfactual trend unaffected by the shocks.

Recent advances in the DiD literature address issues like staggered treatment timing and heterogeneous effects (Goodman-Bacon, 2021; Callaway and Sant'Anna, 2021). However, our setting with uniform national shocks and neighborhood spillovers further complicates identification. The stable unit treatment value assumption (SUTVA) is violated, because outcomes in one municipality may depend on those in neighboring areas, biasing standard DiD estimators.

Given these challenges, we rely on spatial polarization measures and the WALS estimation procedure to capture the dynamics of nationwide shocks and spatial dependence. While we see the value of recent DiD developments, the required assumptions do not fit our setting.

9 Concluding remarks

We have shown that polarization has increased in the Netherlands between 1998 and 2023, that shocks affect polarization, and we conclude (however tentatively) that there is a difference between internal and external shocks: external shocks foster cohesion, while internal shocks lead to polarization.

Is there a connection between what we find at the macro level (a country) to what happens at the meso level (communities) or at the micro level (families)? Matsubayashi et al. (2013, especially Table 5) discuss how shocks enhance social cohesion at the meso level, ultimately reducing suicide. The shocks they consider are natural disasters in Japan, hence these may be viewed as internal at the macro level but external at the meso level. From this viewpoint, their conclusions about social cohesion in Japanese communities align with our conclusions about polarization in the Netherlands.

At the micro level, whether a family grows closer or drifts apart after a shock in the family depends on the interplay of communication, coping strategies, and support systems (Hill, 1949; McCubbin and Patterson, 1983; McCubbin et al., 1996; Conger and Conger, 2002; Patterson, 2002). But does it also depend on the event itself? Evidence is mixed, but the consensus seems to be that the event is less important than the family situation and the support. We find at the macro level that the type of event *does* matter, and hence it seems that families (micro) and nations (macro) do not respond in the same way to shocks.

Sometimes micro behavior and macro behavior correspond, sometimes not. Hofstadter (1979) describes the friendship between an anteater (a mammal who eats ants) and an anthill (a population of ants, individualized as 'Aunt Hillary'), while of course the anteater and the ants are not friends. In the Russell–Copleston debate about the existence of God, Fred-

erick Copleston claims that the universe itself requires an explanation for its existence because everything in the universe does. By applying the same logic, Bertrand Russell replies: 'Every man who exists has a mother, therefore the human race must have a mother,' which is clearly nonsense. In economics there are many examples where macro behavior does not correspond to micro behavior. We have the 'paradox of thrift' in Keynesian economics, the 'division of labor' paradox in labor economics, the 'tragedy of the commons' in consumption theory, and of course the 'free rider' problem.

Our problem falls in the same category, that is, the effect of a shock may be different depending on the level of aggregation: a macro shock may lead to more polarization at the macro level, while a micro shock may lead to more cohesion at the micro level.

Data availability

All data for this research are in the public domain. A full account of the data collection process and its challenges is provided in our online appendix, which can be accessed at https://doi.org/xxx. The online appendix also provides more information about the correlation between vote shares and urbanization depending on whether or not we include distance in the definition of urbanization, and a more extensive robustness analysis.

Conflict of interest

The authors declare no ethical issues or conflicts of interest in this research.

Ethical standards

The authors affirm that this research did not involve human subjects.

Acknowledgements

To follow.

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