






RESEARCH ARTICLE

Beyond rationality. Toward a more comprehensive understanding of the use of negative campaigning

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Abstract

Most scholars agree that candidates' use of negative campaigning is based on rational considerations, i.e., weighing likely benefits against potential costs. We argue that this perspective is far too narrow and outline the elements of a comprehensive model on the use of negative campaign communication that builds on personality traits, values, social norms, and attitudes toward negative campaigning as complementary mechanisms to classical rational choice theory. We test our theoretical assumptions using candidate surveys for twelve state elections in Germany with more than 3,100 candidates. Our results strongly suggest that negative campaigning goes beyond rational considerations. Although benefit–cost calculations are the primary driver of the decision to attack the opponent, other factors are also important and enhance our understanding of why candidates choose to engage in negative campaign communication. Our findings have important implications for research on candidate attack behavior.

Keywords: Negative campaigning; rational choice; personality; values; norms; attitudes; candidate survey; Germany

Introduction

Although its effectiveness is controversial (see, e.g., Lau et al., 2007), negative campaigning – i.e., ‘any criticism leveled by one candidate against another during a campaign’ (Geer, 2006: 23) – is one of the most important strategies in recent election campaigns (e.g., Benoit, 2022; Fowler et al., 2016: 53). The usual explanation for candidates' tendency to go negative is that successful attacks promise to increase their own favorability at the expense of their political opponent. More specifically, candidates are assumed to calculate the benefits – i.e., the ability to reduce the opponent's favorability (Benoit, 2022: 39) – and costs of attacking – i.e., possible backlash effects (Roese and Sande, 1993). Formal models suggest that candidates decide to criticize their opponent if the expected benefits outweigh the likely costs (Polborn and Yi, 2006; Skaperdas and Grofman, 1995). Moreover, since candidates differ in their use of negativity, individual differences in the balance of benefits and costs are used to explain inter-individual variations in attack behavior (e.g., to explain why challengers go negative more often than incumbents; e.g., Polborn and Yi, 2006).

Recently, this explanation has been challenged by three streams of research. First, candidate surveys show that a larger share of candidates attacked their opponent even if the benefit–cost calculation turned out to be negative while other candidates refrained from going negative even if they perceived more benefits than costs (Maier et al., 2023). Second, there is mounting evidence for a

link between candidate personality and negative campaign communication (e.g., Maier et al., 2022; Maier and Nai, 2023; Nai, 2019; Nai et al., 2019; Nai and Maier, 2020; Nai and Martínez i Coma, 2019). Recent research indicates that lacking agreeableness and so-called ‘dark’ personality traits – e.g., psychopathy, narcissism, Machiavellianism – increases the likelihood of going negative. Impulsivity or the need to devalue others are clearly not what is usually subsumed under rational action. Hence, personality profiles of candidates seem to exert a meaningful influence on the likelihood to attack political opponents – *independent* of rational choice considerations. Third, it has been shown that candidates base their choice of campaign communication on the perceived expectations of groups relevant to them. This effect of norms is independent of the considerations of benefits and costs of attacks on political opponents (Oschatz et al., 2024).

The discernible cracks in theoretical explanations of the use of negative campaigning are not surprising since rational choice theory also provides only limited explanatory power for other types of political behavior (e.g., Green and Shapiro, 1994). Thus, it seems important to take up the available evidence on alternative explanatory patterns and gain a broader understanding of the use of attack behavior. This article outlines the elements of a comprehensive approach on the use of negative campaign communication, introducing factors *in addition* to classical rational choice theory, that are suitable for explaining candidates’ attack behavior. Furthermore, we test a model with candidate surveys from Germany to provide evidence on the usefulness of such a broader approach. Our results strongly support that factors beyond benefit–cost calculations such as personality traits, values, perceived norms, or attitudes toward attack behavior explain negative campaigning.

Why do candidates ‘Go Negative’? Unpacking the mechanisms of negative campaigning

Negative campaigning as a rational decision

Rational choice theory assumes that (political) actors approach ‘every situation with one eye on the gains to be had, the other side on the costs’ (Downs, 1957: 7). Since rational choice models usually describe political actors as utility maximizers (Green and Shapiro, 1994: 13), the candidates’ objective is ‘the maximization of the difference between expected support and the expected opponent’s support’ (Skaperdas and Grofman, 1995: 51). If negative campaigning is the result of a rational decision, candidates prefer attacks over other strategies because they consider this strategy as more effective – i.e., perceive a more favorable balance between benefits and costs – than other options (e.g., self-appraisal). As a result, successful attacks should increase a candidate’s ‘net favorability’ (Benoit, 2022: 39).

The mechanism behind attacks, however, is that increasing a candidate’s net popularity comes at the expense of the targeted political opponent (Benoit, 2022: 39), while leaving the reputation of the attacker unchanged. However, the potential benefits of negative campaigning are offset by potential costs. These costs are seen in so-called ‘backlash effects’ (Garramone, 1984; Roese and Sande, 1993) – a situation in which an attack on the opponent hurts the sponsor’s evaluation (Garramone, 1984). Backlash effects arise from the fact that voters by and large do not like attacks (e.g., Fridkin and Kenney, 2019; but see Mattes and Redlawsk, 2014).

The rational choice approach also explains differences in candidates’ use of attacks, which are usually explained *post hoc* by differences in incentive structure (e.g., Maier and Nai, 2023). Important correlates of candidates’ differences in attack behavior are, for example, a candidate’s social (e.g., gender) and political profile (e.g., incumbency), the characteristics of the race (e.g., closeness), the characteristics and the behavior of the political opponent (e.g., gender, negativity of the opponent), or the channel which is used to communicate the message (e.g., ads, social media) (for reviews on the drivers of negative campaigning see, e.g., Haselmayer, 2019; Walter and Nai, 2015).

Candidates' attack behavior does not necessarily have to be a decision originally initiated by the candidate himself, but can also be a consequence of what the competitors do. Following the logic described above – increasing a sender's 'net favorability' (Benoit, 2022: 39) at the expense of the target – being attacked is a potential threat to the public perception of candidates and their chances for electoral success; thus, 'a candidate must respond to attacks by the opponent' (Lau and Pomper, 2004: 33). Image repair theory (Benoit, 2014: 20) suggests that reactions are especially necessary when candidates are made responsible for an action and when the attack is considered offensive.

One possible strategy to respond is to counterattack the attacker. In this way, the attacker's credibility, statements, actions, policies, or associations are called into question (Benoit, 2014: 25), which helps candidates maintain or restore their public image (Ansolabehere and Iyengar, 1995: 117), but also their self-image (Benoit, 2014: 18). According to learning theories explaining human aggression, retaliation should be especially likely when candidates have already learned that counterattacks can have the intended effect (Warburton and Anderson, 2015).

Research shows that candidates' attack behavior is significantly positively associated with their opponents' use of negative campaigning (e.g., Lau and Pomper, 2004: 36). Although the legitimacy of a counterattack is assumed to be higher than that of an initial attack (Dolezal et al., 2016), retaliation is not always wise, and sometimes even dangerous. Therefore, not every attack will be met with a counterattack. For example, attacks by men on female candidates can violate norms of politeness toward women and thus can create the image of a bully (e.g., Fox, 1997; Maier and Renner, 2018). Therefore, male politicians should carefully weigh the pros and cons of counterattacking a female competitor. Moreover, the outcomes of retaliation are more complex in multi-actor races, which are common in parliamentary democracies, reducing the incentives for counterattacks (Dolezal et al., 2016).

Considering all of this evidence, we expect rational choice considerations to play an influential role in explaining attack behavior.

However, empirical evidence that the behavioral differences are actually related to varying benefit–cost calculations is virtually nonexistent. Recent research indicates that the explanatory power of rational choice considerations for negative campaigning is limited (Maier et al., 2023) – a finding that ultimately makes sense, as rational choice considerations are resource-intensive (Lau, 2003), e.g., take time, require cognitive effort or incur costs. Therefore, the question arises as to which other theories can be used to understand why some candidates attack their opponents while others do not.

Complementary mechanisms explaining the use of negative campaigning

Although rational choice is widely used to explain political behavior, other theories that propose mechanisms other than rational choice logic have been found to be useful approaches to understanding individuals' behavior in the political sphere. In what follows, we focus on such bundles of factors that provide us with explanations for the use of negative campaigning that go beyond a purely utilitarian approach. Specifically, we show how i. personality, ii. values, iii. perceived norms, and iv. attitudes relate to candidates' attack behavior.

Personality traits and negative campaigning

Personality, i.e., 'a person's characteristic pattern of behaviors in the broad sense (including thoughts, feelings, and motivation)' (Baumert et al., 2017: 527) – or 'who we are as individuals' (Mondak, 2010: 2) – is connected with the use of negative campaigning. Specifically, using the Big Five Inventory (McCrae and John, 1992), one of the most authoritative concepts for measuring basic personality traits, it has been repeatedly shown that candidates' attack behavior significantly increases with a lack of agreeableness (i.e., the tendency to avoid conflicts, compromise, and

cooperate; Maier and Nai, 2023; Nai, 2019; Nai et al., 2019, 2022), openness (i.e., the tendency to be attracted by new stimuli; Nai, 2019; Nai et al., 2019), and conscientiousness (i.e., the tendency to think carefully and prevent impulses; Nai et al., 2022). Furthermore, research indicates that attacks become more likely when candidates show a ‘darker’, socially aversive personality (e.g., Nai and Maier, 2024), i.e., show ‘a socially malevolent character with behavior tendencies toward self-promotion, emotional coldness, duplicity, and aggressiveness’ (e.g., Paulhus and Williams, 2002: 557).

The impact of personality on campaign style can hardly be explained by differences in incentive structures – or in other words: rational choice considerations. For example, why should agreeable politicians experience different benefits and costs than disagreeable politicians, all other factors held constant? Moreover, such differences in incentive structure would also have to be largely stable, as personality is assumed to be relatively enduring over time (Roberts and DelVecchio, 2000; West and Graziano, 1989) – an assumption confirmed for politicians (Nai and Maier, 2021). Consistent with personality psychology (e.g., Baumert et al., 2017), we argue that it is different cognitive, affective, and motivational processes that are responsible for politicians with different personality traits using different campaign styles in the same situation.

Several personality theories can explain *why* some politicians are hardwired to attack behavior – regardless of whether this behavior is ‘rational’. First, biological theories of personality such as, e.g., the reinforcement sensitive theory, argue that *neuropsychological and endocrine processes* are responsible for inter-individual differences in behavior (Baumert et al., 2017; for a summary see Corr, 2004). With respect to personality traits linked to attack behavior, individuals high on psychopathy have been shown to have limited reflexivity, which constrains their ability to learn from aversive experiences and to use available information to anticipate risk (Patterson and Newman, 1993). Second, social cognitive approaches assume that individual differences in personality reflect differences in the *availability and activation of cognitions* and, because cognitions are interrelated in a unique network, of cognitions linked to them (Mischel and Shoda, 1995). For instance, subjects with a low level of agreeableness lack the ability and the motivation to reason about the mental states of other people and to use such information to, e.g., explain their behavior (Nettle and Liddle, 2008). Third, self-regulatory approaches suggest that inter-individual differences in behavior can be explained by differences in *effortful self-control*, particularly with respect to negative emotions (e.g., Tackett et al., 2019). For example, self-regulation increases with agreeableness. Agreeable individuals are able to effectively manage hostile thoughts by activating prosocial thoughts; thus, aggressive behaviors are less likely in such individuals (e.g., Robinson, 2007). Finally, personality also influences the likelihood with which different *routes of processing information* are used (Van Gelder and De Vries, 2012). Whereas individuals scoring high on conscientiousness are more likely to systematically process information and therefore consider the benefits and costs of their behavior, individuals scoring high on emotionality or on socially aversive traits tend to process information rather automatically than systematically. Emotionality thus increases the likelihood that one’s feelings will be used as a cue for one’s behavior; ‘dark’ politicians use negative campaigning because it makes them feel good: People with an aversive personality show less affective empathy (Wai and Tiliopoulos, 2012), and they tend to take pleasure in others’ misfortune which could be due to their lack of empathy (e.g., James et al., 2014).

Considering all of this evidence, we expect personality traits to play an influential role in explaining attack behavior, independent of rational choice considerations.

Values and negative campaigning

Values are ‘internalized cognitive structures that guide choices by evoking a sense of basic principles of right and wrong (e.g., moral values), a sense of priorities (e.g., personal achievement vs group good), and create a willingness to make meaning and see patterns (e.g., trust vs distrust)’ (Oyserman, 2015: 36). They relate to desirable goals or ‘what is important to us in life’,

‘transcending specific actions and situations’ (Schwartz, 2012: 3–4), but also to the means by which we achieve end goals (Rokeach, 1973). Developed from socialization in the family (Grusec, 2011), values are relatively stable (e.g., Jin and Rounds, 2012) and often collectively shared. Moreover, they serve as a ‘superordinate’ (Converse, 1964: 211), i.e., a bracket that influences more specific subordinate elements, such as norms or attitudes (e.g., Allport, 1961: 802–803; Hurwitz and Peffley, 1987), integrating them into a coherent belief system.

Most importantly, values provide standards that unconsciously influence our choice of actions (Schwartz, 2012: 4). They are the ‘ultimate rationale’ for our actions, but also ‘provide a means of self-regulation of impulses that would otherwise bring individuals in conflict with the needs of the groups and structures within which they live’ (Oyserman, 2015: 37). Accordingly, there is an evolutionarily justified need for the adoption of socially shared values (Oyserman, 2015).

Schwartz (1992) identified a set of core values that are likely to be universal. Two of them might be particularly relevant to understanding the use of negative campaign communication. First, *achievement* describes the goal to have personal success – which in turn ‘generates resources [...] necessary for individuals to survive and for groups and institutions to reach their objectives’ (Schwartz, 2012: 5). Individuals committed to the value ‘achievement’ therefore ‘emphasize the active demonstration of successful performance in concrete interaction’ (Schwartz, 2012: 6). One way to show that one’s own competence and performance is more pronounced than that of competitors, or to be ‘judged as successful by others’ (Schwartz et al., 2012: 666), is to accuse competitors of a deficit in this respect – or in other terms: to attack them.

Second, *power* focuses on the goal of a high ‘social status and prestige, that allows to control or dominate people and resources’ (Schwartz, 2012: 5). Individuals who value power ‘emphasize the attainment or preservation of a dominant position within the more general social system’ (Schwartz, 2012: 6). For these candidates, attacking their political opponents could be seen as an appropriate way of challenging their (claim to) power.

There is indeed evidence, that self-enhancement values like achievement and power are positively associated with interpersonal violence and (cyber-)bullying (e.g., Benish-Weisman, 2015; Menesini et al., 2013). Hence, politicians scoring high on the values ‘achievement’ and ‘power’ should be more likely to attack their rivals.

Considering all of this evidence, we expect values to play an influential role in explaining attack behavior, independent of rational choice considerations.

Perceived norms and negative campaigning

Very different than values that provide an individual guideline for our behavior based on a moral evaluation of what is right or wrong, norms are a product of group influences. By defining norms, the social environment determines which behaviors are allowed or even expected or which behaviors are not supported (Ajzen and Fishbein, 1980; Fishbein and Ajzen, 1975). In other terms: norms are ‘the rules of the game’. In addition to legal or written norms, however, we are also constantly confronted with social norms – i.e., ‘unwritten laws’ – telling us how we should or should not behave. According to social control theory (e.g., Hirschi, 1969; Homans, 1998), we obey social norms because norm violations are likely to be punished. In contrast, following social norms can lead to being valued by others. Sanctions and appreciations are particularly effective if visible to third parties – whereby it is sufficient if the use of such instruments is expected.

Social norms can be differentiated into descriptive and injunctive norms. *Descriptive norms* relate to the perceived prevalence of a certain behavior – i.e., what behavior is common (Cialdini et al., 1990; Rimal and Real, 2005). For example, a politician might observe and/or experience negative campaigning at an increasing rate and thus consider such behavior as appropriate – as a norm in today’s election campaigns. Indeed, research suggests that the (chronic) accessibility of aggressive (political) cues disinhibits individuals’ aggressive behavior (Higgins, 1996: 163). *Injunctive norms* refer to perceptions of the attitudes of important reference groups toward a

specific behavior (Cialdini et al., 1990; Rimal and Real, 2005). Since group identity stimulates ‘individuals’ aspirations to emulate referent others’ (Rimal and Real, 2005: 395), politicians will copy the behavior of other in-group members or conform to the behavior expected from them in order to generate shared positive emotions. The most important reference group will be their party, but their own voters or the electorate in general can serve as a reference group. With respect to negative campaigning, injunctive norms can lead to attacks being made or refrained from, depending on the perceived position of the reference group.

Considering all of this evidence, we expect social norms to play an influential role in explaining attack behavior, independent of rational choice considerations.

Attitudes and negative campaigning

On top of values and norms that may influence the use of attacks, political actors most likely form attitudes toward the use of negative campaigning. Numerous studies show that attitudes, i.e., a psychological tendency to evaluate objects with some degree of favor or disfavor (see Eagly and Chaiken, 1993: 1), are a strong factor influencing political behavior; therefore, it is natural to assume the existence of such a relationship for negative campaigning as well. Although, to our knowledge, we know nothing about how candidates evaluate negative campaign communication, there is some evidence that voters have attitudes about this. Most research shows that voters dislike negativity (e.g., Fridkin and Kenney, 2019, pp. 43–45; Nai and Walter, 2015). Other research, however, is not so skeptical that voters reject negative campaigning outright (e.g., Mattes and Redlawsk, 2014); it has been shown that some segments are even positive about it (Nai and Maier, 2021). Since voters have attitudes toward negative campaigning, we can assume that candidates do as well, and that their opinions on it may very well differ.

Attitudes help candidates cope with the decision to use attacks. Their specific functions (see, e.g., Katz, 1960) serve to protect and enhance the image candidates have of themselves. For instance, while the adjustment function of attitudes focuses on the social rewards and punishments of using attacks and helps candidates determine their behavior from a utilitarian perspective, the ego-defense function of attitudes protects candidates’ self-esteem by justifying their campaign communications through rationalizations or projections, for example. Furthermore, the value-expression function helps reinforce a candidate’s self-concept by expressing positive attitudes toward using (or refraining from using) negative campaigning if they support the candidate’s core values. If attacking the political opponent is believed to be justified, going negative is a less cognitive dissonant experience for candidates and therefore more likely (Martin et al., 1996).

Regarding the use of negative campaigning, the question of whether it is justified to attack the political opponent is probably the most important attitude. Possible justification strategies can be divided into two groups. First, whether attacks can help mobilize voters or increase a candidate’s ‘net favorability’ (Benoit, 2022: 39), both prerequisites for ultimately winning the election. This is in line with more general research on verbal aggression, which shows that aggressive communication is often proactive, instrumental, and goal-directed in order to justify a gain in reputation or to acquire resources (e.g., Volk et al., 2014). Second, negative campaigning is often labeled as unfair, especially when it comes to personal or uncivil attacks (e.g., Fridkin and Kenney, 2019: 45; Geer, 2006: 3). Thus, the use of attacks is often linked to the violation of moral standards. Research indicates that people who morally justify their aggressive behavior often do so by, ‘portraying it in the service of valued social or moral purposes’ (Bandura et al., 1996: 365), which allows aggressors ‘to commit actions [. . .] that would normally contradict their moral standards—without feelings of guilt or remorse’ (Jeong et al., 2024: 29). Moral justifications for aggressive behavior are often reactive, claimed to be a defensive response to threat (e.g., Fung, 2022). In contrast, those who feel that negative campaigning is unfair implicitly argue that the aggressor tends to lack morality, at least as measured by their normative standards (e.g., Folger et al., 2005).

Considering all of this evidence, we expect attitudes toward the use of negative campaigning to play an influential role in explaining attack behavior, independent of rational choice considerations.

Hypotheses

The evidence discussed so far indicates that personality traits, values, perceived norms, and attitudes toward negative campaigning are complementary mechanisms that may explain candidates' attack behavior beyond rational choice considerations. We have shown that these mechanisms are deeply rooted in genetic predispositions, the result of socialization processes, the consequence of group influences, or simply a reaction to protect and enhance the image that candidates have of themselves. Although personality traits, values, perceived norms, and attitudes also have utilitarian components, their stabilizing influence on behavior across different constellations distinguishes them from rational considerations, which depend heavily on the situation at hand. This definitely does not mean that rational choice considerations are obsolete for explaining attack behavior; rather, it means that research on the use of negative campaigning has overlooked other relevant mechanisms that can help explaining why some candidates go negative while others do not. Integrating these mechanisms will improve our understanding of negative campaign communication and lead us to what we would like to call a Comprehensive Model of Candidate Attack Behavior (COMCAB). Based on the outlined theoretical arguments and the available empirical evidence we therefore assume that on top of benefit–cost calculations (H1), negative campaigning can be explained by personality traits (H2), values (H3), perceived norms (H4), and attitudes toward negative campaigning (H5).

To be sure, the mechanisms themselves are linked to the social and political profile of candidates. Rational choice theory attributes differences in behavior to differences in incentive structures (e.g., Maier and Nai, 2023). Furthermore, there is strong empirical evidence that background variables such as personality traits, values, perceived norms, and attitudes often differ between social groups, e.g., men and women (e.g., Hartung *et al.*, 2022; Schwartz and Rubel-Lifschitz, 2009; Weisberg *et al.*, 2011; Wood and Eagly, 2010), and political groups, e.g., by ideology (e.g., Jost, 2006; Jost *et al.*, 2008). Moreover, the different mechanisms are of course not independent of each other. For instance, certain personality traits, e.g., conscientiousness, neuroticism, or dark traits, are likely to influence the extent to which one makes decisions based on rational considerations. Furthermore, personality was shown to be linked to values (e.g., Fischer and Boer, 2015), and values, perceived social norms, and attitudes are hierarchically related (e.g., Hurwitz and Peffley, 1987). This also means that the various mechanisms are not mutually exclusive, but can operate simultaneously.

Methods

We test our hypotheses by using a post-election survey among candidates running for twelve state parliaments in Germany in the years 2021 to 2023 (Baden-Wuerttemberg, Rhineland-Palatinate, Saxony-Anhalt, Berlin, Mecklenburg-Western Pomerania, Saarland, Schleswig-Holstein, North Rhine-Westphalia, Lower Saxony, Bremen, Bavaria, and Hesse; for more information see Table B1 in Appendix B of the online Supplementary material). A full sample was drawn by inviting all candidates to participate (including smaller parties' candidates in 2021).

Surveys are a standard method in elite studies. Their advantage is that they 'deliver the most direct measure of the thoughts and intentions of politicians, making them one of the most valuable sources of data for the study of political behavior' (Bailer, 2014: 168). For this reason, candidate surveys are often conducted as part of national election studies (see particularly the Comparative

Candidate Survey (CCS)).¹ However, the way candidates run their campaigns in terms of attack behavior has not mattered in candidate surveys until recently (see the last round of the CCS program). Although some candidate studies capture negative campaigning, they are not designed to explain candidate attack behavior. Thus, important determinants are missing. For this reason, we conducted surveys specifically designed to study this type of campaign.

Like other surveys, candidate surveys collect self-reported information about attitudes and behaviors. They thus follow a logic on which large parts of social and behavioral science research are based. Since perceptions matter more than reality for attitudes and behavior, the fact that candidates provide us with their view of the world can be considered a major advantage – especially when it comes to behaviors like negative campaigning, where we do not know exactly why candidates behave the way they do. This finding is particularly important since the use of objective data is also not without problems. For example, several studies critically discuss the operationalization of negative campaigning in content analyses, identifying major discrepancies between the definition of negative campaigning in academia and the perceptions of voters and candidates (Lipsitz and Geer, 2017).

Elections and election campaigns at the state level in Germany

With the exception of Bremen, all German states elect their parliament every 5 years. German citizens who are 18 years old have the right to run as a candidate; the right to vote is acquired at the age of 16 or 18, depending on the state.

Although each state has its own electoral system, in most cases they are very similar to the electoral system at the national level.² Most states use a mixed-member proportional representation system (MMP).³ MMP combines the principles of majority voting with proportional representation. To this end, the states have divided their territory into constituencies in which voters can cast a vote for a candidate (usually running for a party); the candidate who receives the most votes (relative majority) is automatically elected to parliament. With a second vote, voters choose a party list on which candidates are ranked.⁴ The share of votes obtained here determines the number of seats a party receives in parliament. Only parties that have achieved a certain share of the vote (5%) will be represented in the parliament; in some states, however, parties with a smaller share of the vote can also be represented in parliament if they have won a certain number of constituencies ('Grundmandatsklausel'). The difference between the constituencies won directly and the total number of seats to which a party is entitled, based on the share of second votes, determines how many candidates enter parliament via the party list. From the candidates' point of view, therefore, it should make a big difference whether they just run in a constituency (in which they depend on their own performance), just run on a party list (in which they depend on the performance of their party), or whether they are running both in a constituency and on the party list.

Little is known about differences in campaigning between the federal and state levels and by type of candidacy. As far as the use of negative campaigning is concerned, it can be assumed that it is less common in state elections. State elections are considered so-called second-order elections, which are conducted less professionally, for example in terms of budget, consultation, or advertising (e.g., Tenscher, 2013). Furthermore, the use of an attack strategy is often seen as a characteristic of a professionally run campaign (e.g., Vliegenthart, 2012). Indeed, a recent study comparing negative communication in national and European election campaigns in 28 countries

¹See www.comparativecandidates.org.

²For an overview with access to the election laws see <https://www.wahlrecht.de/landtage/>; see also Reutter (2021).

³Exceptions are Bremen and Saarland, both of which use a purely proportional representation system.

⁴Although Baden-Württemberg uses an MMP, voters only have one vote.

shows that political actors attack more in first-order elections than in second-order elections (Maier *et al.*, 2024).

Participants

A total of $N = 7,532$ candidates ran for office in the examined state elections. $N = 7,379$ candidates could be contacted successfully and were invited to participate in the survey. 43.1 percent ($N = 3,182$) answered the questionnaire (see Table B1 in Appendix B of the Supplementary material). Whereas there are no significant differences between participating and non-participating candidates with respect to gender, age, or governmental status, candidates from left-wing and liberal parties are overrepresented and candidates from conservative and right-wing parties are underrepresented (see Table B2 in Appendix B). We had to remove 854 participants due to missing data on the concepts studied and/or speeding through the questionnaire (to identify speeders, we used the procedure proposed by Leiner, 2019), leaving us with $N = 2,328$ candidates. 34% of the candidates in the final sample were female. Participants were between 19 and 88 years old ($M = 47.73$, $SD = 13.83$).

Procedure

Data were collected online and by mail during a period of two months. On the day after the elections, candidates with a publicly provided personal email address were invited by email with a personalized link to an online questionnaire. The remaining candidates received a printed questionnaire and a prepaid return envelope by post. In addition, a link to the online questionnaire was included in the printed version, should they prefer to participate online. Participants were instructed to fill out the questionnaires personally. In total, two reminders were sent out to increase the response rate.

Measures⁵

Dependent variable

The use of negative campaigning was assessed with the question (1=never, 5=very often): ‘*How often did you attack the political opponent, that is, criticizing other parties or candidates?*’ ($M = 2.69$, $SD = 1.01$).

Self-reports about the use of negative campaigning might suffer from validity issues. For instance, candidates might rationalize or downplay their past behavior *ex post*. However, there are good reasons to believe that in the context of our study social desirability is a less severe issue. Political candidates – especially when they are running for office – have strong incentives to be sincere; honesty, sincerity, and integrity are perhaps the most important image traits that voters look for in competing candidates (Holian and Prysby, 2014). Furthermore, it is not clear *per se* what qualities and behaviors politicians themselves find desirable; for instance, candidates may consider tactical skill and a certain ruthlessness to be prerequisites for being truly successful in the political arena (for this argument see also Schumacher and Zettler, 2019). Consequently, there is little reason to assume that candidates systematically downplay attack behavior.

To validate self-reported attack behavior with external measures, we performed two comparisons with external benchmarks. First, we compared the self-reported level of candidates’ attacks, aggregated by election and party, with the use of negative campaigning of those same parties as assessed by an expert survey (for this approach, see Maier and Nai, 2023).⁶ Results show

⁵For an overview of all items used in the study including the original German wording see Table A1 in Appendix A. For descriptive statistics of the variables used see Table A2 in the Appendix.

⁶The surveys were conducted with Alessandro Nai (University of Amsterdam). We used the concept he developed for expert surveys on negative campaigning. See <https://www.alessandro-nai.com/negative-campaigning-comparative-data>.

high correlations (see Figure C1 in Appendix C). Second, we compared the self-reported use of negative campaigning, aggregated by election and party, to the classification of a machine learning model trained to identify attacks posted by candidates on their Facebook and Twitter accounts (for this approach see Sältzer et al., 2024).⁷ We find a strong correlation between subjective and objective measures (see Figure C2 in Appendix C). The correlation is weaker, but still $r = 0.24$ when comparing candidates' reported attack behavior with their share of negative campaigning on social media platforms at the individual level. This is to be expected as self-reports measure attack behavior across all communication channels, among which Facebook and Twitter are only a specific subset (see Figure C3 in Appendix C).

Independent Variables

Rational considerations. We examine two aspects of rational considerations of attack behavior. First, we measure what *costs and benefits* candidates see when they attack the political opponent. Perceived benefits of negative campaigning were measured with the question: *'In your opinion, to what extent are advantages associated with attacking a political opponent?'* To assess the costs of negative campaigning we asked: *'In your opinion, to what extent are disadvantages associated with attacking a political opponent?'* For both items, a 5-point scale ranging from 1 ('no advantages/disadvantages at all') to 5 ('very large advantages/disadvantages') was provided. To assess the benefit–cost calculus, we subtracted perceived costs from perceived benefits. A positive differential indicates that perceived benefits outweigh perceived costs (for this approach see also Maier et al., 2023). Descriptive statistics show that, across all candidates, perceived costs were slightly greater than perceived benefits ($M = -0.30$, $SD = 1.63$). Second, we measure the *influence of attacks by political opponents* on a candidate's attack behavior. To measure whether candidates have been attacked by their political rivals, we ask the following question (1=never, 5=very often): *'How often have you been attacked by your political opponents?'* ($M = 2.78$; $SD = 1.21$).

Personality traits. We measure basic personality traits with the German version of the Brief HEXACO Inventory (BHI–24) (de Vries, 2013; Twardawski et al., 2021; for the concept of the HEXACO model see, e.g., Ashton and Lee, 2007). The short-scale includes six dimensions: Honesty – Humility, i.e., the tendency to be sincere and fair (e.g., *'It's hard for me to lie'*; $M = 4.10$, $SD = 0.59$, Cronbach's $\alpha = 0.40$), Emotionality, i.e., the tendency to show empathy and attachment (e.g., *'I worry less than others'*; $M = 2.66$, $SD = 0.70$, Cronbach's $\alpha = 0.41$), Extraversion, i.e., the tendency to engage in social endeavors (e.g., *'I can easily get into contact with strangers'*; $M = 4.26$, $SD = 0.67$, Cronbach's $\alpha = 0.58$), Agreeableness, i.e., the tendency to be tolerant and cooperative (e.g., *'I am quick to agree with others'*; $M = 3.26$, $SD = 0.60$, Cronbach's $\alpha = 0.37$), Conscientiousness, i.e., the tendency to be organized and task-oriented (e.g., *'I work very accurately'*; $M = 3.61$, $SD = 0.65$, Cronbach's $\alpha = 0.53$), and Openness, i.e., the tendency to be curious and imaginative (e.g., *'I like people with odd ideas'*; $M = 3.78$, $SD = 0.64$, Cronbach's $\alpha = 0.45$). Each dimension was represented by four facets (1=strongly disagree, 5=strongly agree). Two items of the honesty-humility dimension were slightly adapted in the German version to avoid high non-response rates. Furthermore, we excluded the item *'I am rarely excited'* from the extraversion index because it correlated negatively with the scale (see Appendix A).

Aversive or 'dark' personality traits were measured with the Political Elites Aversive Personality Scale (PEAPS, Maier et al., 2023; Maier et al., 2024) which is particularly tailored to measure self-reported aversive personality among politicians, i.e., the tendency to violate generally accepted ethical, moral, and social standards. The scale consists of six items reflecting the dark core of personality (1=strongly disagree, 5=strongly agree) (e.g., *'People who mess with me always regret it'*; $M = 2.56$, $SD = 0.69$, Cronbach's $\alpha = 0.66$).

⁷The IRB approval covers linking candidates' survey responses with external sources. These linking possibilities were explicitly mentioned to the candidates in the informed consent form.

Values. To measure the values ‘power’ and ‘achievement’, we adapted the German version of the Portrait Values Questionnaire (PVQ–40; Schmidt *et al.*, 2007; Schwartz *et al.*, 2001); question wording was tailored to measure self-reported values among politicians (1=strongly disagree, 5=strongly agree). *Power* is an index based on three items (e.g., ‘Taking the lead and telling others what to do; getting others to do what I say’; $M = 2.23$, $SD = 0.83$, Cronbach’s $\alpha = 0.66$). *Achievement* was measured with four items (e.g., ‘To get ahead in life; to strive to be better than others’; $M = 2.68$, $SD = 0.96$, Cronbach’s $\alpha = 0.82$).

Social norms. We measure descriptive norms with the generally perceived prevalence of negative campaigning by asking the candidates if they agree with the following statement: ‘The election campaign was characterized to a large extent by mutual attacks’ (1=strongly disagree, 5=strongly agree) ($M = 2.73$, $SD = 1.23$).

Attitudes toward negative campaigning. To measure candidates’ attitudes toward negative campaigning, we assessed their evaluation of three different aspects of attack behavior (1=strongly agree, 5=strongly disagree): ‘Attacks on the political opponent are a legitimate means of gaining an advantage in the election campaign.’ ($M = 3.01$; $SD = 1.11$), ‘If attacks on the political opponent have only the goal of gaining an advantage, that is unfair.’ ($M = 2.55$; $SD = 1.25$; reversed for analysis), and ‘Attacks on the political opponent are justified because they can mobilize one’s own voters.’ ($M = 2.94$; $SD = 1.09$).

Control variables

To account for a possible direct impact of the candidates’ profile (and thus not to exaggerate the effect of the specified mechanisms), we controlled for the following variables in the overall model: (1) the candidate’s gender (0=male, 1=female), (2) incumbency (whether the candidate campaigned as an active member of the parliament; 0=no, 1=yes), (3) governmental status (running for a party represented in the government; 0=no, 1=yes), (4) ideology (1=left to 11=right, $M = 4.79$; $SD = 2.27$), and (5) extremism (measured by folding the ideology scale on itself, $M = 2.06$; $SD = 1.55$). Furthermore, we control for (6) state to account for differences in the electoral systems and for regional differences in negative campaigning.

Results

We calculated a multiple OLS linear regression model to explain the use of negative campaigning by the candidates’ rational considerations, their personality traits, values, perceived social norms, and attitudes toward negative campaigning. Following Maier and Nai (2023), we further determine the explained variance of each of the suggested mechanisms (minimum R^2) to assess their relative importance. The minimum R^2 of each set of predictors is determined by including them in the model after the effects of all other variables have been taken into account (see, e.g., Cohen *et al.*, 2003: 205). An F -test shows whether the observed increase in R^2 is significant, and whether our hypotheses are supported or have to be rejected. Analysis of the variance inflation factor indicates that multicollinearity is not an issue (see Table B3 in Appendix B).

Our results support our theoretical assumptions to a large extent (see Table 1). Candidates’ attitudes toward negative campaigning ($R^2_{\min} = .045$, $p < 0.001$), personality traits ($R^2_{\min} = 0.008$, $p < 0.001$), and to some extent values ($R^2_{\min} = 0.003$, $p < 0.05$) and perceived social norms ($R^2_{\min} = 0.001$, $p < 0.05$) contribute to explaining the candidates’ use of negative campaigning over and above individual rational choice considerations ($R^2_{\min} = 0.072$, $p < 0.001$) (full model: $F(31, 2296) = 40.91$, $p < 0.001$, $R^2_{\text{adj}} = 0.347$). Hence, all hypotheses can be confirmed.

Table 1. Determinants of candidates' use of negative campaigning across twelve German state elections

	<i>b</i>	<i>SE</i>	<i>beta</i>	<i>p</i>	Min <i>R</i> ²
<i>Rational Choice</i>					0.072***
Balance benefits – costs	0.129	0.012	0.207	<0.001	
Retaliation	0.168	0.015	0.199	<0.001	
<i>Personality</i>					0.008***
Honesty-humility	–0.036	0.035	–0.021	0.297	
Emotionality	0.018	0.027	0.012	0.513	
Extraversion	0.038	0.028	0.025	0.168	
Agreeableness	–0.113	0.032	–0.067	<0.001	
Conscientiousness	0.006	0.028	0.004	0.835	
Openness	0.071	0.028	0.044	0.013	
'Dark' personality	0.064	0.031	0.043	0.042	
<i>Values</i>					0.003*
Achievement	–0.061	0.025	–0.058	0.013	
Power	–0.020	0.029	–0.016	0.491	
<i>Social Norms</i>	0.039	0.016	0.047	0.017	0.001*
<i>Attitudes</i>					0.045***
Legitimate	0.140	0.021	0.154	<0.001	
Unfair (reverse)	0.046	0.016	0.057	0.003	
Justified	0.098	0.022	0.105	<0.001	
<i>Control variables</i>					0.034***
Gender	–0.030	0.010	–0.057	0.002	
Incumbency	0.019	0.015	0.022	0.208	
Governmental status	–0.079	0.010	–0.144	<0.001	
Ideology	0.026	0.010	0.058	0.011	
Extremism	0.063	0.014	0.097	<0.001	
<i>State (Schleswig-Holstein = 0)</i>					
Bremen	0.030	0.033	0.018	0.370	
Lower Saxony	–0.006	0.025	–0.006	0.805	
North Rhine-Westphalia	–0.026	0.023	–0.031	0.273	
Hesse	0.058	0.026	0.056	0.027	
Rhineland-Palatinate	–0.019	0.023	–0.024	0.423	
Baden-Wuerttemberg	–0.002	0.022	–0.002	0.944	
Bavaria	0.022	0.024	0.031	0.347	
Saarland	–0.040	0.030	–0.029	0.188	
Berlin	–0.008	0.024	–0.010	0.735	
Mecklenburg-Western Pomerania	–0.027	0.027	–0.024	0.325	
Saxony-Anhalt	–0.024	0.028	–0.021	0.377	

Note: *N* = 2,296 candidates who ran in German state elections. All independent variables were set to a range between 0 and 1. Last column: Minimum *R*² of each set of predictors is determined by including them in the model after the effects of all other variables have been taken into account. An *F*-test was used to determine whether the increase in *R*² is significant. Full model: *F*(31, 2296) = 40.91, *p* < 0.001, *R*²_{adj} = 0.347.

Significance levels:

****p* ≤ 0.001.

***p* ≤ 0.01.

**p* ≤ 0.05.

To be clear, our results suggest that negative campaigning does have a strong rational component. However, there are other – more psychological – factors at play that are based on very different mechanisms than the calculation of benefits and costs – and the empirical relevance of these factors cannot be neglected; their joint impact accounts for at least for 6.6 percent of the explained variance (see Table B8 in the Appendix). Including these mechanisms improves our model.

Looking at the variables subsumed under the various specific categories, we see that the direction of the rational considerations of costs and benefits is as expected.⁸ The more the perceived benefits exceeded the perceived costs, the more frequently a candidate attacked the political opponent (*b* = 0.13, *p* < 0.001). Interestingly, when costs and benefits are included as

⁸Note that all independent variables were set to a range between 0 and 1.

separate variables in the regression model, results show that the decision to attack their opponents relied on the likely benefits to a much greater extent ($b=0.17, p<0.001$) than on the potential costs ($b=-0.09, p<0.001$) (see Table B4 in Appendix B); this difference is statistically significant ($p<0.001$). One potential explanation is that candidates, like other people, tend to overestimate the likelihood of experiencing positive events while underestimating the likelihood of experiencing negative situations. This optimistic bias (e.g., Weinstein, 1980) correlates with higher perceived control of future events (Klein and Helweg-Larsen, 2002). When we ask our candidates to balance benefits and costs of negative campaigning *themselves*, we find a strong, but not a perfect correlation with the measure we used in Table 1 ($r=0.60, p<0.001$), suggesting that candidates place a different weight on the pros and cons of attack behavior.⁹ We therefore suggest that future research should clarify whether the premise that candidates give equal accounts of benefits and costs is correct. Furthermore, candidates who reported being attacked by their political opponents showed a higher likelihood of going negative ($b=0.17, p<0.001$). Among personality traits, agreeableness ($b=-0.11, p<0.001$), openness ($b=0.07, p<0.05$), and ‘dark’ personality ($b=0.06, p<0.05$) emerged as significant predictors of the use of negative campaigning. The less forgiving and willing to compromise the candidates were, the more open they were to new experiences, and the more they showed behavior that violated generally accepted ethical, moral, or social standards, the more likely they were to attack their opponents. Values only partially explained candidates’ use of negativity. Interestingly, achievement showed a negative effect on attack behavior ($b=-0.06, p<0.05$). The more a candidate strived to personal success, the less likely a candidate was tempted to go negative. However, the end does not seem to justify the means. As achievement is measured with a positive connotation (e.g., ‘to impress people’) it is not easily accommodated with negative campaign behavior.

Attack behavior as a perceived descriptive norm was also linked to candidates’ own behavior. The more candidates reported mutual attacks as a means of campaigning, the more likely they went negative on their opponents ($b=0.04, p<0.05$). In addition, all attitudes toward negative campaigning specified in the regression model proved to be significant predictors of candidates’ self-reported use of attacks. Going negative increased when candidates believed that attacks are a legitimate means of gaining an advantage ($b=0.14, p<0.001$), that negative campaigning is fair ($b=0.05, p<0.01$), and that this strategy can mobilize their own supporters ($b=0.10, p<0.001$).

Although we have captured a whole range of mechanisms, some control variables still had an independent influence on candidates’ use of negative campaigning. This is especially true for gender (male candidates resorted to attacks more often than female candidates; $b=-0.03, p<0.01$), government status (candidates who ran for a governing party showed lower levels of attacks than candidates who ran for an opposition party; $b=-0.08, p<0.001$), ideology (conservative candidates attacked more than left candidates; $b=0.03, p<0.05$) and ideological extremity (candidates who positioned themselves on the fringe of the political spectrum were more likely to attack than ideologically moderate candidates; $b=0.06, p<0.001$). Since the effects of all these variables on negative campaigning are usually explained by positive and negative incentives, and thus by underlying rational considerations, this result supports the observation that the presumed mediating role of the benefit–cost differential on the effects of candidate profiles on negative campaigning is often absent (Maier *et al.*, 2023). However, their effects do not appear to be captured by alternative mechanisms.

Robustness checks

A series of robustness checks replicated the main results discussed above. First, as parties are important places where candidates learn how their own party wants to approach election

⁹The question was: ‘All in all, would you say that attacking the political opponent ...’ (1) ‘only has disadvantages for one’s own election campaign’ (5) ‘only has advantages for one’s own election campaign’.

campaigns, we have extended our model presented in Table 1 by party dummies. Results still supported our hypotheses, i.e., that factors beyond rational choice considerations significantly explain the use of attacks (see Table B5 in Appendix B). Second, for a subset of four elections, we additionally assessed social norms with an improved measure reflecting the candidates' most important reference groups (Oschatz et al., 2024).¹⁰ Descriptive norms captured whether candidates perceived that members of their own party used attacks on their political opponents during the election campaign. Injunctive norms measured whether candidates believe that their own voters accept the use of attacks as an appropriate campaign strategy. Other reference groups are irrelevant for the consideration of whether to attack or not (Oschatz et al., 2024). Including this information leads to a substantial increase in the minimum R^2 of social norms, but also has the effect that the incremental R^2 for personality traits and values is no longer significant. Therefore, using this (smaller) data set H2 and H3 have to be rejected. Nevertheless, our main argument that factors beyond rational considerations contribute to our understanding of candidates' attack behavior is still valid. In line with Oschatz et al. (2024), our results show that candidates have their party members and voters in mind when it comes to attacks. If they believe that their fellow party members (do not) use negative campaigning or that their voters think that attacks are (not) appropriate, they (don't) go negative – regardless of whether such attacks can be beneficial for them. Third, instead of measuring the frequency of attack behavior, we measure whether or not a candidate attacked during the campaign. Our dependent variable is now a binary variable (0=never used negative campaigning, 1=used negative campaigning). Results show that personality traits, values, and social norms no longer significantly increase the R^2 of the model; therefore, H2, H3, and H4 have to be rejected. However, the influence of attitudes toward negative campaigning beyond rational choice considerations is still clearly present (see Table B7 in Appendix B). Again, our core argument that other factors than rational considerations are predictors of candidate attack behavior is supported.

Discussion

What motivates candidates to criticize their political opponents during an election campaign? Most scholars who study the use of negative campaigning would probably say that such a decision is the result of rational deliberation based on weighing the likely benefits against the potential costs. Moreover, they would likely argue that individual differences in the use of attacks reflect individual differences in the tradeoff between benefits and costs. To the best of our knowledge, these strong, widely accepted assumptions are not supported by empirical evidence.

With this article, we would like to advocate for dissolving the theoretical narrowness that characterizes the explanation of candidates' campaign communication and for raising awareness that other, alternative mechanisms can also explain the decision to go negative. To this end, we have outlined how personality traits, values, perceived social norms, and attitudes toward negative campaigning may explain candidates' attack behavior *in addition* to rational choice theory. Based on a candidate survey among 3,100+ candidates running in a recent German state election, we find strong support that negative campaigning is more than rational considerations. Although benefit–cost calculations are one of the most important drivers of the decision to attack the opponent (with a strong tendency for candidates to focus on benefits rather than costs), all other factors are also influential and enhance our understanding of why candidates choose to engage in negative campaign communication. In other terms: Candidates attack political opponents not only because they believe that doing so is beneficial to them overall or they have learned that retaliation is a successful strategy to protect their image when being attacked (rational considerations), but also because they are hardwired to show this type of behavior (personality), because they associate attack behavior with personal achievements in life (values), because they see

¹⁰Information on injunctive norms is only available for the elections in Bavaria, Bremen, Hesse, and Lower Saxony.

that it is normal for other candidates to criticize (descriptive norms), and because they have certain opinions about whether it is appropriate to attack political opponents (attitudes toward negativity).

Our approach comes with limitations. First, our findings are based on a single country – Germany. There is, of course, nothing wrong with country-specific case studies; many studies on attack behavior focus on a single country (usually the USA). The question arises, however, as to what weight the bundles of factors we have identified have in other contexts and thus to what extent our results can be generalized beyond the German case. Second, although there are good arguments that analyzing the perceptions of candidates has advantages, it also raises the problem that candidate responses can be tainted by social desirability or processes of rationalization. However, triangulation of our dependent variable with expert data and candidates' behavior on social media shows that this issue is not severe. Third, we have analyzed the bundles of factors influencing the general use of attacks. Negative campaigns, however, can take very different forms and vary in terms of target, focus, or level of incivility. Further research should therefore test whether our findings are confirmed for more specific forms of negativity. In addition, future research should consider new ways of modeling the decision to go negative. For example, a candidate's decision could not only be the result of the calculation of benefits and costs, but also how this calculation compares to other strategies (e.g., acclaims). Fourth, some of the measures were suboptimal – for instance, the measure used to capture basic personality traits was based on short scales with low empirical reliability, or the measurement of social norms was not particularly fine-grained. Fifth, the characteristics of an attack's target are an important factor influencing the candidates' use of negativity (Ansolabehere and Iyengar, 1995, pp. 121–127; Maier and Renner, 2018). Thus, future research should more closely examine the dynamics between the sender and target of an attack. Sixth, our analyses are based on survey data that only allow us to draw conclusions about correlations between candidate attack behavior and our independent variables. Future work should therefore focus on the analysis of causal models to further explore the process nature reflected in our theoretical considerations. Seventh, although our aim was to theoretically and empirically show how factors that do not follow a rational choice logic influence candidates' attack behavior, we have discussed the relationships between these variables only superficially. Future research should look more closely at the causal links between these factors in order to move from a comprehensive model to a theory of negative campaign communication.

Our article lays the groundwork for such research. On the one hand, we have proposed an extended model of negative campaign communication. Although this article has set a starting point, we believe that the COMCAB model is not yet complete. More categories of explanatory variables – e.g., target characteristics – should be added. In addition, factors already identified – for example, social norms – should be measured in more detail. Since much of the variance in attack behavior – about 65 percent in our model – is still unexplained, such efforts can help us further complete our understanding of the drivers of negative campaigning. Moreover, because the mechanisms outlined are intended to apply not only to attack behavior but also to other varieties of campaign behavior, our approach can serve as the basis for a general theory of candidates' campaign communication. On the other hand, we have demonstrated that candidate surveys seem particularly useful for this endeavor. Using this method of data collection allows us to dig much deeper for explanations of why negative communication is (increasingly) preferred by candidates. This method can capture concepts that are very difficult to measure, such as candidates' (aversive) personality traits, can provide access to more unknown candidates and candidates from smaller parties, and overall can help advance comparative research in campaign communication.

Since negative campaigning is here to stay, developing more sophisticated theories and collecting more meaningful data at the individual level is essential. We hope that our article has paved some of the way ahead.

Supplementary material. The supplementary material for this article can be found at <https://doi.org/10.1017/S1755773925000025>

Data availability statement. Since our data contain sensitive, non-anonymized information from candidates, the data can be only made available to other researchers on request.

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Competing interests. The authors report there are no competing interests to declare.

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