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Combining ideological and policy distances with valence for a model of party competition in Germany 2009

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Abstract
This paper addresses two problems: how can we identify a verisimilar policy space and how can we detect Nash equilibria in this space for parties' policy positions? We argue that the ideological party positions that voters perceive are fixed during the time span of one electoral campaign and that they constrain the policies parties offer the electorate in search of optimal vote shares. We apply the valence model developed by Schofield to party competition during the German federal election campaign 2009. First three issue scales are combined with a left–right scale to form one homogeneous space in which equilibrium locations of parties are sought. The results show that local Nash equilibria in this combined space depend heavily on the start values and are implausible. Fixing the ideological dimension leads to a stable and meaningful equilibrium configuration in which large parties move to more central positions and smaller parties move to more peripheral positions in the policy space.

Keywords
Construction of policy spaces; issue voting; local Nash equilibrium; party competition; spatial model

1. Introduction

Spatial models of party competition focus on strategies of parties for vote maximizing or optimal policy attainment, whereas voting specialists explain the decisions of the general electorate. These decisions are, to a large extent, standing decisions which parties cannot influence in the short term. Combining ideological and policy distances with valence constitutes an exercise in combining long- and short-term motives for the vote which allows us to study constraints on party competition by the ideological reputations of parties and by valence components. Ideological images of parties are fixed for longer

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time periods and important components of party valences, such as party competence, are built on retrospective evaluations. Thus, the only factors of the original Michigan model left for campaign strategies are issue positions. Here parties have some leeway when planning an election campaign. In contrast to applications of spatial models which rely exclusively on left–right positions, we analyze party competition assuming that the space in which parties maneuver in order to reach their goals is made up of multiple issue dimensions. When an ideological dimension such as left–right is added it will function as a constraint on position taking, and not just like another dimension in an otherwise homogeneous policy space. We will offer indirect evidence for this central hypothesis by showing that plausible equilibrium positions in a combined ideological and policy space cannot be identified.

The first task for a study of party competition is the selection of a model whose assumptions are plausible for the party and electoral system of the chosen case and the available data on the electorate. Thus, for Germany the model has to be suited to multi-party systems under proportional representation and should be able to handle more than one policy dimension. Judged from the consequences for possible equilibrium configurations, an important question is what to assume concerning party motivations. Will parties try to maximize vote shares or participation chances in the next coalition government or are the strategies of parties better captured by imputing intrinsic policy motivation to them? We will explain our choice in the following section.

Our second task is to clarify the type of policy space which we are able to construct on the basis of available data for the German federal election of 2009. In the literature on the application of spatial models we find one-dimensional ideological spaces like left–right or sets of issue preference questions in voting studies from which latent policy spaces are derived by factor analysis etc. We will describe our data basis in Section 2 together with a method for identifying verisimilar party positions as perceived by voters. Our aim is to construct a policy space that combines concrete issues of the electoral campaign and the ideological left–right scale, the idea being that parties are relatively free to choose issue positions whereas they are constrained regarding their ideological image in the electorate, at least in the short run of an election campaign.

In Section 3 we will present our descriptive evidence for both issue and ideological dimensions of the common policy/ideological space based on a pre-election survey of the German electorate in 2009. We assume that a voter's utility from a party is higher the less distant the party position is from the voter's issue preferences and ideological self-placement. For each party we shall compare the distribution of their voter and supporter ideal points on the ideological left–right scale and on issue scales for nuclear energy, immigration and taxes versus social services. These three issues were debated controversially during the election campaign 2009.

Section 4 is dedicated to equilibrium analyses. First we test whether the electoral mean of the combined ideological and policy space fulfills the conditions of a Nash equilibrium for the party strategies, when taking valence differences between the parties into account. The result is ambivalent for the four-dimensional space. But holding the party positions on the ideological space constant and searching iteratively for optimal issue positions results in a configuration similar to the estimated issue positions but closer to the electoral mean and gives realistic party vote shares. The fixed left–right scale impedes full maneuverability of the parties, whereas otherwise implausible leap-frogging would

occur. Thus, it performs a function as party identification similar to that in the model of Adams (2001) or Adams et al. (2005, Chapters 4–6).

2. A model for party competition in Germany

Not every model of party competition qualifies equally for application to each type of party and electoral system. Party systems differ in the number of parties and the number of minimally necessary ideological and policy dimensions. Furthermore, the type of electoral system has an influence on party motivations. In plurality systems or majority systems with two rounds, parties may either try to maximize their expected vote shares or to maximize 'vote margins relative to each other' (Merrill and Adams, 2001: 353). Proportional systems also motivate parties to maximize vote shares if voters vote sincerely and not strategically, perhaps with preferred coalitions in mind. Even if the *Bundestag* gets elected by a mixed system combining first past the post for the candidate first ballot and proportionality for the party list second ballot, we shall only analyze the second ballot which almost exclusively determines the seat shares in parliament. Therefore, we assume vote share maximizing on the side of the parties and sincere voting on the side of the electorate.

Erikson and Romero (1990) were among the first to empirically identify equilibrium positions of parties in a concrete policy space. They studied the American two-party system and already included non-policy factors about which they concluded: 'The more complicated one's model of voters' motivations, the greater appears to be the chance of locating a candidate equilibrium position in policy space' (Erikson and Romero, 1990: 1103). Afterwards many authors focused on valence as introduced by Stokes (1963) into the literature[1] and studied how the equilibrium strategies of candidates or parties are influenced when they differ in valence (cf. Groseclose, 2001; Adams et al., 2005; Schofield and Sened, 2006).

We shall apply the valence model that was primarily developed by Schofield who, on the other hand, mentions Lin et al. (1999) and McKelvey and Patty (2006) as his sources. This model combines a non-policy related valence term that captures the perceived competence and reputation of parties with a spatial term measuring the policy distance between voters' preferences and parties' policy supply. The model assumes that parties are purely office seeking, which translates into a multiparty system by assuming parties to maximize vote shares. Therefore, the valence model perfectly fits the German party system. Another reason for relying on the valence model is its flexibility in applying it to different political settings, which results in a large number of already existing empirical applications of the model, e.g. to elections in the UK, Israel, the Netherlands or Turkey (see, for example, Schofield, 2004, 2005; Schofield and Sened, 2005a,b 2006; Schofield et al., 2011a,b). This illustrates the importance of the model in empirical research and enables us to compare our results and integrate them into a broader framework of party competition research.

We assume that the distribution of voters' preferences over issue dimension k is given by their ideal points $\{x_{ik} \in X\}_{i,k \in N}$, where X is an open and convex subset of Euclidean space $\Re$. It is assumed that each party j selects a policy, $z_j \in X$ for each k prior to the election, and communicates it to the electorate. The utility of voter i for each party j is assumed to decline monotonically as the distance between their policy ideal points

increases and is further specified by

$$u_{ij}(x_i, z_j) = \lambda_j - \sum_{k=1}^{\omega} \beta_k (x_{ik} - z_{jk})^2 + \epsilon_{ij} \tag{1}$$

where λ_j is the exogenous defined valence of party j. Here β_k is a vector of positive constants of a length corresponding to the number of dimensions of the policy space ω. The term $(x_{ik} - z_{jk})^2$ denotes the quadratic distance between voter i's policy ideal point and party j's policy offer with respect to issue k. The term ϵ_{ij} is the error of the model and is assumed to be distributed according to a Type I generalized extreme value distribution.

It is assumed that each voter i votes for each party j with a certain probability, in order to maximize his utility. The probability is given by

$$\rho_{ij}(\mathbf{z}) = \Pr[[u_{ij}(x_i, z_j) > u_{il}(x_i, z_l)], \text{ for all } l \neq j] \tag{2}$$

which can also be written as

$$\rho_{ij}(\mathbf{z}) = \Pr\left[\left[\lambda_j - \sum_{k=1}^{\omega} \beta_k (x_{ik} - z_{jk})^2 - \lambda_l + \sum_{k=1}^{\omega} \beta_k (x_{ik} - z_{lk})^2 > \epsilon_{il} - \epsilon_{ij}\right], \text{ for all } l \neq j\right] \tag{3}$$

Because the error terms follow a Type I extreme value distribution, the difference of both terms follows a logistic distribution, such that we receive the conditional logit model of the form

$$\rho_{ij}(z) = \left[1 + \sum_{l \neq j} \exp(f_l)\right]^{-1}$$

$$\text{where } f_l = \lambda_l - \sum_{k=1}^{\omega} \beta_k (x_{ik} - z_{lk})^2 - \lambda_j + \sum_{k=1}^{\omega} \beta_k (x_{ik} - z_{jk})^2$$

Each party chooses a vector of policies z_j that maximizes its vote share given the strategies of all other parties, z_{-j}. Equilibrium points can be found by maximizing the vote share function

$$V_j(\mathbf{z}) = \frac{1}{n} \sum_{i \in N} \rho_{ij}(\mathbf{z}) \tag{4}$$

of each party conditional on the policy positions of all other parties $\mathbf{z}_{-j}$. A computer-based step-wise optimization algorithm searching iteratively for best responses to the other parties' best responses is a helpful tool to detect possible local Nash equilibrium (LNE) configurations. Furthermore, it can be tested whether the strategy vector in which all parties locate themselves at the electoral mean constitutes a Nash equilibrium, as the *mean voter theorem* suggests. Schofield (2007) derives necessary and sufficient conditions for the joint electoral mean to be an LNE. An extension to the case in which we do

not have only one distance parameter β for all dimensions, but separate β-coefficients for every dimension, can be found in the appendix of Schofield et al. (2011b). According to this, the mean voter theorem can easily be tested with empirical data, as it only requires the electoral covariance matrix, ∇_0, the parties' valences λ_j and the estimated β parameters as data input. Based on these parameters, the characteristic matrix for the lowest valence party can be calculated as

$$C_1 = 2(1 - 2\rho_1)\boldsymbol{\beta}\nabla_0\boldsymbol{\beta} - \boldsymbol{\beta} \tag{5}$$

where $\boldsymbol{\beta}$ stands for a diagonal matrix of the β_k and ∇_0 is the covariance matrix of voters' ideal points with respect to the ω distinct ideological and issue dimensions. In addition, the convergence coefficient needs to be calculated according to the following formula

$$c(\boldsymbol{\lambda}, \boldsymbol{\beta}) = \frac{2(1 - 2\rho_1)trace(\boldsymbol{\beta}\nabla\boldsymbol{\beta})}{\frac{1}{\omega}(\beta_1 + \beta_2 + \cdots + \beta_\omega)} \tag{6}$$

The necessary conditions for the joint mean to be an LNE are stated in the *mean voter valence theorem* of Schofield (2007), where he also provides a proof, and in the appendix of Schofield et al. (2011b).

Mean Voter Valence Theorem. (For different coefficients: $\beta = \beta_1, \beta_2, \ldots, \beta_\omega$)

(i) The joint mean satisfies the first-order condition to be an LNE.

(ii) A necessary condition for the joint mean to be an LNE is that the trace of the characteristic matrix C_1 is smaller than zero: $trace(C_1) < 0$.

(iii) A necessary condition for the joint mean to be an LNE is that the convergence coefficient is bounded above by the number of policy dimensions: $c(\lambda, \beta) < \omega$. □

In a next step we extend the model by separating the ideological distance between voters and parties from the policy distances, assuming that ideological party positions are fixed and issue positions are pliable as already proposed by Grossman and Helpman (2001: 64–72). The underlying argument for this restriction of party behavior is that party positions on the ideological left–right dimension evolved out of a long-term development. It is assumed that the perceived left–right position of a party captures the overall integration of the party's behavior in a rather long-term context, whereas the concrete issue dimensions capture current party standpoints that have been only recently communicated in the framework of an ongoing public discussion or the most recent party manifesto. Following this rationale, the perceived party position on the left–right dimension is evaluated by the voter on the basis of the parties' behavior on many concrete issues during the past campaigns, but also on the basis of a party's actual behavior in coalition government or in opposition (this is also empirically shown by Fortunato and Stevenson, 2013). Furthermore, a current shift on the issue dimensions would not necessarily lead to a shift in the current left–right placement, as the evaluation of the left–right placement integrates the current issue dimensions in a broader framework that also considers past issue positions and general statements of the party. This assumption is in line with the recent empirical work of Adams et al. (2011), who analyzed the dynamics of the responses of voters to party shifts during elections in several European countries. They found that voters do not adjust their perception of parties' left–right positions in response

to shifts of left–right policy statements in party manifestos of the current elections. Following this logic of reasoning, we assume the perceived ideological left–right placement of parties to be unchangeable during the current election campaign.

Thus, the ideological distance can be regarded as an additional valence term in the model that is exogenous and varies for individuals. The policy space, in which parties are free to move their positions in order to gain votes in the competition with other parties, consists only of concrete issue dimensions. Hence, we specify the utility of voter i for each party j to be defined by

$$u_{ij}(x_i, z_j) = \lambda_j - \alpha(v_i - \tau_j)^2 - \sum_{k=1}^{\omega} \beta_k (x_{ik} - z_{jk})^2 + \epsilon_{ij} \tag{7}$$

where $(v_i - \tau_j)^2$ describes the quadratic ideological distance between voter i's ideological ideal point v_i and party j's ideological position, denoted by τ_j. The parameter α represents the relative weight of the ideological distance on the voter's utility. For this extended utility function, the corresponding conditional logit model is given by

$$\rho_{ij}(z) = \left[1 + \sum_{l \neq j} \exp(f_l) \right]^{-1}$$

$$\text{where } f_l = \lambda_l - \alpha(v_i - \tau_l)^2 - \sum_{k=1}^{\omega} \beta_k (x_{ik} - z_{lk})^2 - \lambda_j + \alpha(v_i - \tau_j)^2 + \sum_{k=1}^{\omega} \beta_k (x_{ik} - z_{jk})^2$$

Again, each party chooses a vector of policies z_j that maximizes its vote share given the strategies of all other parties, $\mathbf{z}_{-j}$. Yet in this case, the ideological dimension is not included in the policy space and thus $\mathbf{z}_j$ is a vector only containing party positions on concrete issue dimensions. Equilibrium points can be found by maximizing the corresponding vote share function via a step-wise optimization algorithm that successively finds best responses for each party regarding the strategy vectors of all other parties. The vote share function for this model is more complex than the one of Schofield's valence model described above, because it includes the individual–specific ideological distance as an additional valence term. Therefore, the mean voter valence theorem as stated above cannot be applied in order to test whether the joint electoral mean on all policy dimensions constitutes an LNE for all parties. However, such a test can be made using the optimization algorithm. When setting the initial party configuration to the joint mean 0, we can test whether this configuration is an LNE or whether parties have an incentive to move their positions away from the mean.

3. Constructing policy spaces

Spatial theories of party competition combine the demand and supply side of electoral market focusing on policy preferences of citizens and on the policies offered by political parties. These two sides are brought together in common policy or ideological spaces in which voters are located by their policy preferences or ideological leanings and parties

by their signaled policy offers or ideological reputation. A second distinction can be made between perceptual and preference spaces. The first approach is based on survey questions when respondents are asked where on a pre-defined scale they perceive the positions of various parties. The second approach relies on policy preference data both of voters and of parties.

When relying on perceptual questions, the researcher gets direct access to party positions as perceived by individual respondents and has to fit their policy preferences into the perceptual space. The easiest way to do this is to use the distance between a respondent's preference and a party position as perceived by her on the same scale as a measure of utility loss: the larger this individual distance, the larger the utility loss. Even if these individual distances guarantee good predictions of vote intentions, their big disadvantage occurs at the supply side. Parties have to communicate with voters about their policy offers and this communication process presupposes a common understanding of what a party is telling the public about its policy as compared with the messages of the other parties. Thus, researchers interested not only in issue voting but also in party strategies (e.g. Adams, 2001; Adams et al., 2005) frequently rely on mean perceptions, even if the distances between a respondent's position and the parties' positions as perceived by the average voter reduce the predictive power of issue voting. The advantage of non-ambiguous party positions is bought by the heroic assumption that the respondents agree on the meaning of the numeric values of the interval scale presented to them. From a measurement point of view it first has to be tested whether a common scale for all parties and the self-placements of the respondents can be derived.

In surveys issue preferences of respondents are easier to collect than perceptual data and may also deliver more valid information. A hint in that direction is that more respondents answer preference than perceptual questions. But without information on party positions from respondents, this information has to be imputed from other sources and the researcher has to assume that the respondents know these positions anyway. With perceptual data from the respondents this assumption can be tested. Our first conclusion concerning the construction of policy and ideological spaces is to rely on perceptual data on party positions which are augmented by data on the respective policy preferences of the electorate.

Comparing perceptual policy and ideological dimensions, one difference has already been mentioned. In the short term parties can change their issue positions more easily than their ideological image. In addition we believe that this image does not only depend on the policy statements in party manifestos but also on coalition decisions of parties. These are more visible to the electorate than signaled policy statements and can also be interpreted as ideological signals. What does this mean for the ideological preferences of voters? We interpret them as ideological leanings through which a voter relates herself to the party system thereby using left–right distinctions as an orientation device (cf. Hinich and Munger, 1994). A simple question on the ideological leaning of the respondent without party perceptions seems to be less relevant than concrete policy preference questions. A hint for this conjecture is that here the pattern of don't knows is the other way around compared to issue questions: More respondents answer the left–right perceptual questions than the self-placement question. We mention these results because the relation between the policy preferences of respondents and their perceptions of party positions seems not to be the same for ideological and policy questions and cannot be reduced

to the social psychological problem of persuasion and projection effects (cf. Markus and Converse, 1979) or the process of attitude attribution (cf. Sniderman et al., 1991: 93–119). Our second conclusion concerning the construction of policy and ideological spaces is to include policy distances in search of party strategies to maximize vote shares and to include ideological distances in search of a long term view of the party system and the location of individual voters within it.

When parties try to improve their vote shares by position signaling for important issues they must have an expectation about the party and voter configuration and the possible vote share improvements by position changes. We argue that a policy space derived from voter perceptions and preferences for important issues is a perfect data base for applying spatial models of party competition. With these data it can be checked whether the means of the perceived party positions are verisimilar when compared with party positions derived from other sources such as party manifestos. In addition, it is necessary to find out which respondents agree with the verisimilar configuration and entertain a more or less correct view of the party configuration and which respondents do not agree. When the percentage of respondents with incorrect views of the party system is too large, parties would have problems in building their election campaigns on such issues. Identifying respondents with correct and incorrect views requires a scaling procedure which tells us how individual respondents use the predefined rating scales. The standard survey instrument to measure parties' policy or ideological positions are interval scales, running from 1 to 7, e.g., which have labeled endpoints such as 'left' at one and 'right' at the other endpoint.

Aldrich and McKelvey (1977) developed a scaling method for such data, which will deliver a joint scale for unique party positions and diverse voter ideal points. They assume that the true party positions are perceived by respondents with some variance. Yet, since the scale presented to the respondent lacks a common metric, the respondent does not tell the interviewer (w_{ij}) her more or less correct perception of party j's position, but an arbitrary linear transformation of his perception of the space (Aldrich and McKelvey, 1977: 113). The respondent uses her own anchor c_i and her own transformation coefficient v_i. Thus, the position z of party j is perceived as follows:

$$\hat{w}_{ij} = c_i + v_i z_j \tag{8}$$

Only one issue is analyzed at a time. The expectation of the individual derived perceptions are assumed to be true party positions z_j. These are extracted as the first eigenvector of a characteristic matrix computed only from the original observations w_{ij}. Once the c_i and v_i are computed from the perceptual data, the respective policy preference or ideal point y_i can be computed by inserting the reported preference x_i on the original rating scale into an equation analogous to (8), only that this time all variables and parameters on the right-hand side are known:

$$\hat{y}_i = c_i + v_i x_i \tag{9}$$

The individual transformation coefficients v_i can be used to check the homogeneity of the individual perceptions of party positions. In general, the smaller the variance around the mean the more homogeneous are the perceptions. But before that, the sign of the v's should be checked. If the party means for an issue scale are ordered from low left

to high right values, then a positive sign of v_i indicates a correct understanding of the scale provided that the means agree with other measures of the left–right positions of these parties. Thus, a high percentage of respondents agreeing in the sign of their v_i's, say for instance more than 80%, can be used by the parties as evidence that they are able to communicate with voters concerning the respective issue area. We shall see in the next section which issues fulfill this condition.

4. The German electoral campaign 2009

Data on voters' ideal points and perceived party positions are derived from the German longitudinal pre-election study 2009.[2] In addition to the vote intention in the upcoming *Bundestag* election, this survey also asked respondents to report their self-placement on the ideological left–right scale plus their perception of party positions on the same scale. The parties analyzed here are the five parties that eventually entered the parliament. Those are the Christian Democrats CDU/CSU[3] (C), the Social Democrats SPD (S), the Liberal Party FDP (F), the Greens (G) and the leftist party Linke (L). In addition to the ideological placement, respondents were also asked to state their preferences regarding three concrete policy issues, which concern nuclear energy, immigration and taxation policy, and the perceived party standpoints towards those issues. These item batteries offer an excellent basis for the construction of a policy space as described above, which can be sub-divided into one ideological and three policy dimensions. The survey would also contain questions on competence and sympathy of parties and their leaders, that is information from which valence measures could be derived. Since we are primarily interested in combining issue and ideological positions of voters and parties, we follow the suggestion of Schofield and his various co-authors (Schofield, 2004, 2005; Schofield and Sened, 2005a,b 2006; Schofield et al., 2011a,b) to interpret the constant term of a conditional logit analysis of the vote choice as party valences.

The survey contains information on 2173 respondents. However, as the East German region was purposely over-sampled during the sampling procedure, we reduced the East German sample by randomly dropping observations until the ratio between East and West German respondents corresponded to the empirical population ratio of about 1:4, thereby making the sample representative for the German electorate. The resulting data set includes 370 respondents residing in East Germany and 1390 respondents living in West Germany. This number of cases is furthermore reduced to respondents with non-missing values regarding the left–right self- and party-placement and to respondents with correct transformation coefficients within the rescaling procedure described above.[4] Respondents need to have perception values for all five parties in order for us to apply the rescaling method of Aldrich and McKelvey (1977). Because in some cases West German respondents did not report perception values for the Linke regarding the three policy issues, we imputed those values by randomly drawing from the distribution of valid perception values of the Linke within the data set if the respondent has valid values regarding all other parties.[5] Eventually, there are 982 respondents remaining in the final data set, which is the basis for all following analyses. The sample proportions of reported votes for the five parties CDU, SPD, FDP, Greens and Linke are 32.9%, 26.9%, 11.7%, 14.5% and 14.1%, respectively. These are quite similar to the actual vote shares of 33.8%, 23.0%, 14.6%, 10.7% and 11.9%. However, voters of the left-wing parties

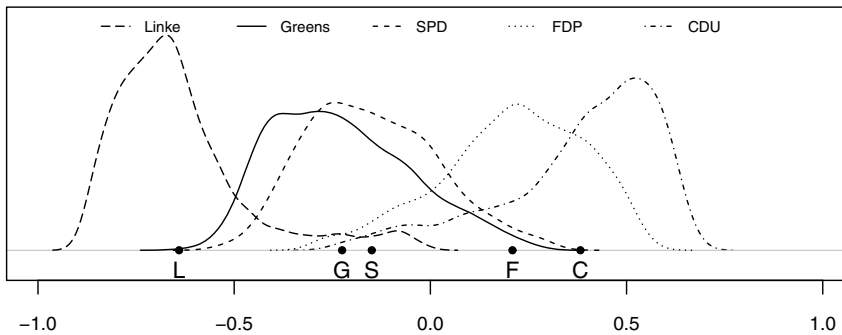

Figure 1. Density curve of the perceived party positions on the ideological left–right scale. Points indicate mean party positions.

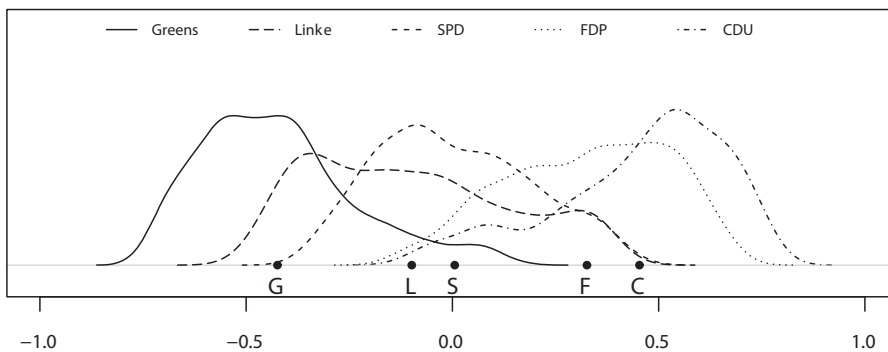

Figure 2. Density curve of the perceived party positions regarding the nuclear power issue. The left endpoint stands for an immediate shutdown of nuclear power stations, the right endpoint for a further expansion of nuclear energy. Points indicate mean party positions.

SPD, Greens and the Linke are marginally over-represented, whereas voters of the FDP are slightly under-represented in the sample. This should be kept in mind during the following analysis.

After the issue-wise application of the rescaling method, the resulting perception and preference values are transformed such that they are centered around the mean of the voters' ideal points distribution regarding the respective ideological or issue dimension. Hence, the scale value of 0 corresponds to the position of the mean voter, and not to the midpoint of the original scale. Figures 1 and 2 illustrate the distribution of the party perceptions among the respondents regarding the ideological left–right position and the party standpoints towards the nuclear energy issue. Regarding the ideological placement, respondents have a quite clear opinion on where to place the parties, as can be seen by

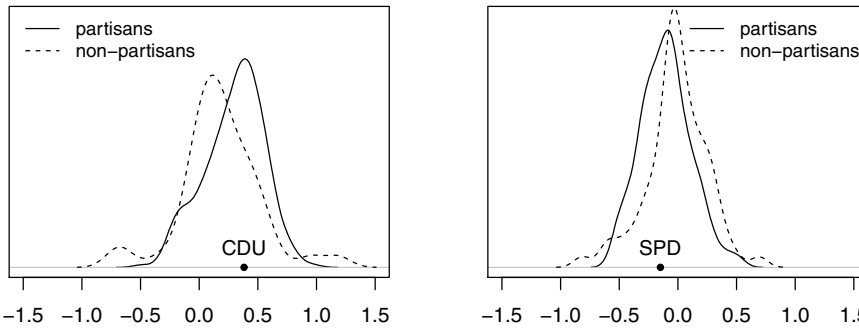

Figure 3. Density curves of the partisans' and non-partisans' ideal points on the ideological left–right scale of voters of the CDU and SPD. Points indicate mean rescaled party positions as perceived by the electorate.

the relative high and narrow peaks of the density curves. All parties are perceived to take quite distinct positions, except the SPD and the Greens, whose perception curves are overlapping in large parts. The leftist party Linke is clearly perceived to be on the extreme left of the ideological scale. The CDU is perceived to be the most right-wing party. The FDP is also perceived to be located on the right part of the scale; however it has a very wide density curve, suggesting that its ideological position is not as clearly articulated as that of the Greens, for example.

Regarding the concrete policy issues, the density curves are flatter and less peaked, indicating that parties' standpoints are not that clearly perceived by the respondents as ideological positions. Figure 2 shows this exemplarily for the nuclear energy issue. In this case the standpoint of the Green party, which emerged from the anti-nuclear energy movement in the 1980s, is clearly perceived to be at the extreme left, whereas the CDU is also clearly perceived to represent the opposing standpoint. The other parties overlap to a large extent.

It is worthwhile to take a closer look at the voters' ideal point distribution regarding certain issues and parties. Figure 3 shows the distribution of the ideal points regarding the ideological left–right scale for voters of the CDU and SPD. Separate curves are drawn for respondents who reported to be partisans of the respective party. It shows that those respondents who identify with the respective party have more extreme ideal points. The peak of the density curve of the respondents who are party identifiers of the CDU is more to the right than the respondents who voted for the CDU, but did not describe themselves as partisans. Concerning the SPD, the partisans are located more to the left than the non-partisan voters. In both cases, the parties' mean position is located more towards the peak of the partisans' distribution.

Similar patterns can be detected when investigating the voter distribution with reference to the three issue dimensions, as exemplified in Figure 4. In all cases, the partisans' ideal points tend to be located more to the extreme of the scale than the non-partisan voters' preferences, whereas the party is perceived by the general public as taking a position somewhere in between the peaks of the two distributions.

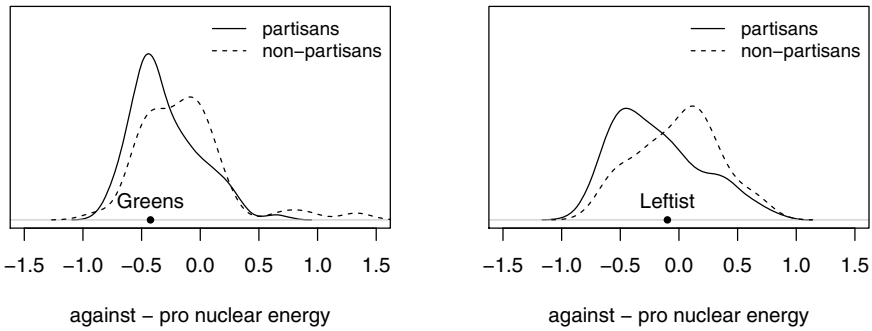

Figure 4. Density curves of the partisans' and non-partisans' ideal points regarding the nuclear energy issue of voters of the Greens and the Linke. Points indicate mean party positions.

In order to get estimates for the party valences λ_j and the α and β_k coefficients of the distinct ideological and policy dimensions, a conditional logit model is fitted to the data. The results of this model are reported in Table 1, where the final model is derived by successively adding constant terms for all parties, a parameter for the ideological distance and eventually adding parameters for the policy distances. The distance measures are operationalized by calculating the squared difference between the voter's rescaled ideal point on the respective ideological or policy dimension and the rescaled mean perceived party position on that dimension. If a respondent has missing values regarding one policy distance, because she did not give complete answers to the item battery regarding one specific issue, or because she has an incorrect transformation coefficient, we imputed a distance measure of 0 towards all parties for that respondent. Hence, we do not have to drop the whole case because of one missing policy issue, but at the same time the case cannot bias the coefficient.

In Model 1 only constant terms for the parties are included. The size of the coefficients reflect the vote share each party gets in the sample relative to the vote share of the FDP, which is the base category. In order to interpret those coefficients as valence, controls for the policy factors influencing the vote decision have to be included in the model. When including only the left–right distance between voters and parties, the model fit increases, as the decrease in the log likelihood and the McFadden R^2 value of 0.216 tell. It is also striking that the introduction of the ideological distance increases the coefficient and the level of significance of the constant term for the Linke. Thus, ideological distance brings this party closer to the large parties CDU and SPD, indicating a valence impact beyond ideological proximity.

In a next step, the policy distances are also included, as shown in Model 3. The co -efficients of the policy distances are all significant and point to the right direction, meaning that an increase of distance between voter and party decreases the probability that the voter will vote for that party. However, the impact on the vote decision is relatively small as compared with the ideological distance, as the smaller absolute values of the policy coefficients tell. The inclusion of those policy factors nevertheless leads to a significant increase in the McFadden R^2 by 0.026. The coefficients of the constant terms for

Table 1. Results of conditional logit model of vote choice.

	Model 1	Model 2	Model 3
CDU	1.03***	1.18***	1.27***
	(0.11)	(0.11)	(0.11)
SPD	0.83***	0.81***	0.74***
	(0.11)	(0.12)	(0.13)
Greens	0.21	0.24	0.37*
	(0.13)	(0.13)	(0.15)
Linke	0.18	0.84***	0.85***
	(0.13)	(0.15)	(0.16)
FDP	*base*	*base*	*base*
Distance on left–right scale		−5.45***	−5.07***
		(0.31)	(0.32)
Distance on nuclear energy scale			−1.78***
			(0.25)
Distance on immigration scale			−0.56 *
			(0.22)
Distance on taxes versus social benefits scale			−1.23 **
			(0.46)
Log likelihood	−1498	−1174	−1135
McFadden $R^{2\dagger}$		0.216	0.242
Likelihood-ratio test††		647***	79***
		(df=1)	(df=3)

Standard errors in brackets. Signif. codes: 0 '***', 0.001 '**', 0.01 '*'; $N = 982$.

† With reference to Model 1. ††For Model 2 with reference to Model 1; for Model 3 with reference to Model 2.

the parties of Model 3 are interpreted as valence measures, as this model controls for policy factors. We obtain the following estimates for the party valences and the spatial coefficients as components of the voters' utility function:

$$(\lambda_C, \lambda_S, \lambda_F, \lambda_G, \lambda_L) = (1.27, 0.74, 0, 0.37, 0.85)$$
$$(\alpha) = (5.07)$$
$$(\beta_1, \beta_2, \beta_3) = (1.78, 0.56, 1.23)$$

Since one may assume problems regarding collinearity between ideological and policy preferences of voters we have a further look at the correlations regarding voters' ideological and issue preferences, as shown in Table 2.

There is a positive relationship between all four dimensions; however, the correlation coefficients are not so large that we should be worried. What is most striking, however, are the variance values presented in the bottom row. The voters' ideal point distribution regarding the immigration issue exhibits the largest variance of 0.19. Relying on the estimated coefficients of the conditional logit model in Table 1, however, this policy issue has the smallest impact on the vote decision. This counterintuitive finding becomes more plausible when taking a look at the distribution of voters' ideal points and the party positions regarding the immigration policy dimension, as shown in Figure 5. Remember that the data points have been centered around the mean of the voter distribution. Thus,

Table 2. Correlation and variance of voters' ideological and policy preferences.

	l-r	n.e.	imm.	tax
l-r	1	0.32	0.27	0.34
n.e.	0.32	1	0.25	0.28
imm.	0.27	0.25	1	0.19
tax	0.34	0.28	0.19	1
Variance	0.12	0.11	0.19	0.09

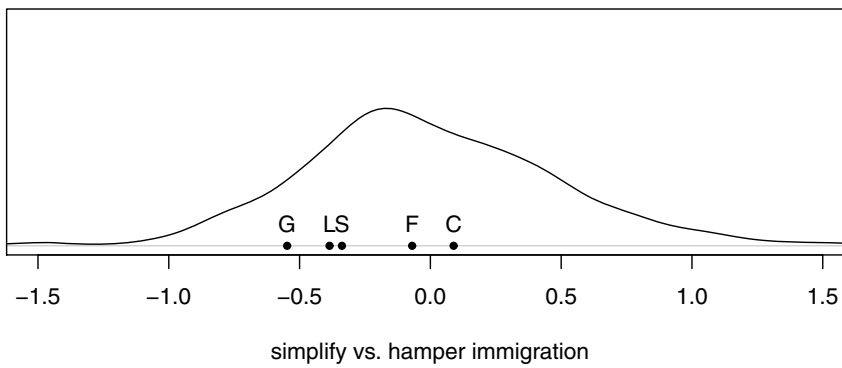

Figure 5. Density curves of the voters' rescaled ideal points on the immigration policy scale. Points indicate mean party positions.

the zero-point on the x-axis represents the mean voter. All but one party are positioned to the left of the mean voter's position. This indicates that although voters actually do have quite diverse opinions regarding immigration policy, parties do not respond to that by offering policy positions attracting the diverse voter preferences. It is nearly impossible for voters on the right side of the mean to base their vote decision on the immigration issue, as there is no party representing their position. This explains the relatively small coefficient for the distance parameter regarding immigration policy resulting from the conditional logit model. It is not the voters who do not put emphasis on immigration policy, as could be suggested on first sight, but the parties that do not capitalize on their chances on this policy dimension.

5. Equilibrium analysis

As a starting point, it will be tested whether the joint mean of the electoral distribution regarding the ideological as well as the policy dimensions satisfies the necessary conditions to be an equilibrium point for all parties when relying on Schofield's valence model. Therefore, we have to compute the expected vote shares ρ_j that every party would receive if it was located at the mean, $\mathbf{z} = \mathbf{z}_0$

$$V_j(\mathbf{z}_0) = \big(0.34\ 0.20\ 0.10\ 0.14\ 0.22\big)$$

In this scenario, the FDP would have the lowest vote share, as it is the party with the lowest estimated valence. It is therefore taken as the reference party for the following calculation of the characteristic matrix C_j (cf. Equation (5)) and the convergence coefficient $c(\lambda_j, \beta)$, applying Equation (6). The variance–covariance matrix ∇_0 and the characteristic matrix C_j for the FDP as the party with the lowest valence are as follows:

$$\nabla_0 = \begin{bmatrix} 0.122 & 0.036 & 0.041 & 0.036 \\ 0.036 & 0.107 & 0.035 & 0.027 \\ 0.041 & 0.035 & 0.185 & 0.025 \\ 0.036 & 0.027 & 0.025 & 0.091 \end{bmatrix}; \quad C_F = \begin{bmatrix} 0.016 & 0.529 & 0.190 & 0.360 \\ 0.529 & -1.233 & 0.058 & 0.097 \\ 0.190 & 0.058 & -0.469 & 0.028 \\ 0.360 & 0.097 & 0.028 & -1.006 \end{bmatrix}$$

with $trace(C_{FDP}) = -2.69$ and the convergence coefficient $c(\lambda_F, \beta) = 2.75$. As $trace(C_F) < 0$ and $c(\lambda_F, \beta) < 4$, a necessary condition for the joint mean to be an LNE as stated above in the mean voter valence theorem is satisfied. The eigenvalues of C_F $(0.36, -0.52, -1.11, -1.43)$, on the other side, indicate a saddle point and not a vote share maximum.[6] Since the theorem only states necessary but not sufficient conditions, one could try to bring further evidence that the mean constitutes a local equilibrium point. This is done by simulation, for which the initial party positions in the optimization procedure are set to the joint mean on all four dimensions. The result of the simulation procedure confirms that the mean 0 is an LNE for all parties, because no party moves away from this position in the simulation procedure, following a short-sighted strategy in the neighborhood of $\mathbf{z}_0$.

Searching for additional LNEs by simulation, we set the initial positions to the parties' rescaled mean perceived positions. Thus, the initial coordinates are given by

$$\mathbf{z}_{initial} = \begin{bmatrix} party & C & S & F & G & L \\ l\text{-}r & 0.382 & -0.149 & 0.209 & -0.225 & -0.640 \\ n.e. & 0.453 & 0.006 & 0.326 & -0.424 & -0.099 \\ imm. & 0.089 & -0.338 & -0.070 & -0.548 & -0.385 \\ tax & 0.137 & -0.143 & 0.167 & -0.152 & -0.386 \end{bmatrix},$$

with the corresponding vote shares

$$V_j(\mathbf{z}_{initial}) = \begin{pmatrix} 0.329 & 0.269 & 0.117 & 0.145 & 0.141 \end{pmatrix}$$

For the simulation process, an order has to be determined in which the parties are allowed to adjust their positions as best responses to the other parties' positions. Setting this order to be CDU–SPD–FDP–Greens–Linke leads to the following simulated LNE configuration:

$$\mathbf{z}_{sim.} = \begin{bmatrix} party & C & S & F & G & L \\ l\text{-}r & -0.000 & 0.019 & 0.238 & -0.180 & -0.001 \\ n.e. & 0.000 & 0.011 & 0.128 & -0.096 & -0.000 \\ imm. & 0.002 & 0.015 & 0.136 & -0.118 & 0.003 \\ tax & 0.002 & 0.016 & 0.152 & -0.120 & 0.002 \end{bmatrix},$$

and the corresponding expected vote shares at this LNE are

$$V_j(\mathbf{z}_{sim.}) = \begin{pmatrix} 0.335 & 0.198 & 0.101 & 0.145 & 0.221 \end{pmatrix}.$$

In this equilibrium configuration all parties take more centered positions than their original ones, with the one exception of the FDP moving more to the right on the immigration and the taxes versus social benefits dimension. The higher valence parties CDU, SPD and Linke are the most central parties, and the FDP and Greens take the most extreme positions on the right and left side of the scales, respectively. However, the SPD is passing the CDU on its way towards the right on the ideological and on all policy issue scales. This is an unlikely scenario. Furthermore, even the leftist party Linke moves to the right of the conservative CDU on the immigration scale and takes an identical position regarding the tax versus social service issue.

In addition, if the order according to which parties adjust their positions in the simulation process is reversed, we get the following quite different LNE configuration:

$$\mathbf{z}_{sim.} = \begin{bmatrix} party & C & S & F & G & L \\ l\text{-}r & 0.015 & 0.094 & -0.244 & -0.147 & 0.068 \\ n.e. & 0.009 & 0.051 & -0.129 & -0.078 & 0.037 \\ imm. & 0.012 & 0.061 & -0.164 & -0.094 & 0.045 \\ tax & 0.013 & 0.065 & -0.164 & -0.096 & 0.048 \end{bmatrix},$$

with the corresponding expected vote shares:

$$V_j(\mathbf{z}_{sim.}) = \begin{pmatrix} 0.335 & 0.201 & 0.100 & 0.140 & 0.223 \end{pmatrix}$$

In this case, the FDP takes the most extreme positions on the left side on every dimension, whereas the SPD takes the most rightist positions. The Linke moves to a position in the middle between the CDU and the SPD. This also is an unrealistic scenario to happen in the German party system. Furthermore, it illustrates the sensitivity of the model concerning the sequence of parties' moves in the simulation process and the possibility of parties leapfrogging each other, which is an especially undesirable feature regarding the ideological left–right dimension because of credibility.

In summary, we conclude that the equilibrium analysis based on the assumption that parties are free to adjust their positions not only on the policy dimensions, but also on the ideological left–right scale is not very illuminating as it leads to results that do not necessarily reflect the reality of reasonable party behavior. The simulation demonstrated that there is more than one equilibrium configuration, however the equilibria we found are still extremely centrist and far away from the empirically observed configuration. For this reason we now conduct an equilibrium analysis on the basis of our extended model in which parties are not assumed to be able to adjust their ideological left–right position on short notice.

First, we test the joint mean as an LNE on the three policy dimensions by simulation. If it would be an LNE no party would have an incentive to move its position when we set the starting points for the simulation algorithm to be at the joint mean. However, the simulation procedure converges at the following configuration:

$$\mathbf{z}_{sim.} = \begin{bmatrix} party & C & S & F & G & L \\ l\text{-}r & 0.382 & -0.149 & 0.209 & -0.225 & -0.640 \\ n.e. & 0.066 & -0.044 & 0.081 & -0.073 & -0.140 \\ imm. & 0.093 & -0.043 & 0.102 & -0.080 & -0.196 \\ tax & 0.089 & -0.042 & 0.103 & -0.077 & -0.175 \end{bmatrix},$$

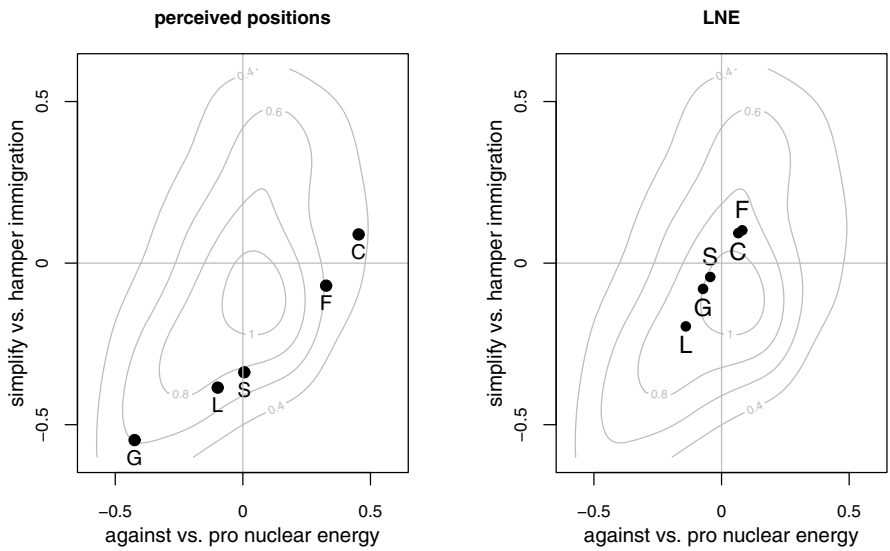

Figure 6. Voter distribution and party positions regarding nuclear energy and immigration.

with the corresponding vote shares:

$$V_j(\mathbf{z}_{sim.}) = \begin{pmatrix} 0.344 & 0.240 & 0.112 & 0.160 & 0.143 \end{pmatrix}$$

This proves that the joint mean of the three issue dimensions does not constitute an LNE if parties are constrained on the ideological dimension. Investigating the simulated equilibrium configuration further, it is remarkable that the left-wing parties SPD, Greens and Linke take positions on the left half of the scale regarding all three issue dimensions, whereas the CDU and FDP are located to the right of the mean voter on all issues. This clearly is in line with the empirically observed pattern. Furthermore, the two large parties CDU and SPD take the most moderate positions on all dimensions, whereas the smaller and lower valence parties are located at more extreme points of the scales. This is in accordance with the expectations of theoretical arguments made for example in Schofield (2007) and Groseclose (2001).

In order to investigate whether there are other LNEs to be found in the neighborhood of the mean perceived party positions, we took those positions as starting points for further simulations. The resulting equilibrium configuration is the same as above, even if the party sequence of moves is changed. In a next step we set the starting points to be the mean position of the partisans' ideal point distribution of the respective party, and still the simulation converges at the same equilibrium configuration as above. This is a strong hint that this LNE is the only one within the range of meaningful party positions.

Figures 6 and 7 illustrate the configuration of the equilibrium points regarding the three policy dimensions compared with the perceived party positions. It is striking that the order of the parties in equilibrium is the same on all three policy dimensions, and strongly resembles the left–right ordering of the parties. Furthermore, the parties seem to

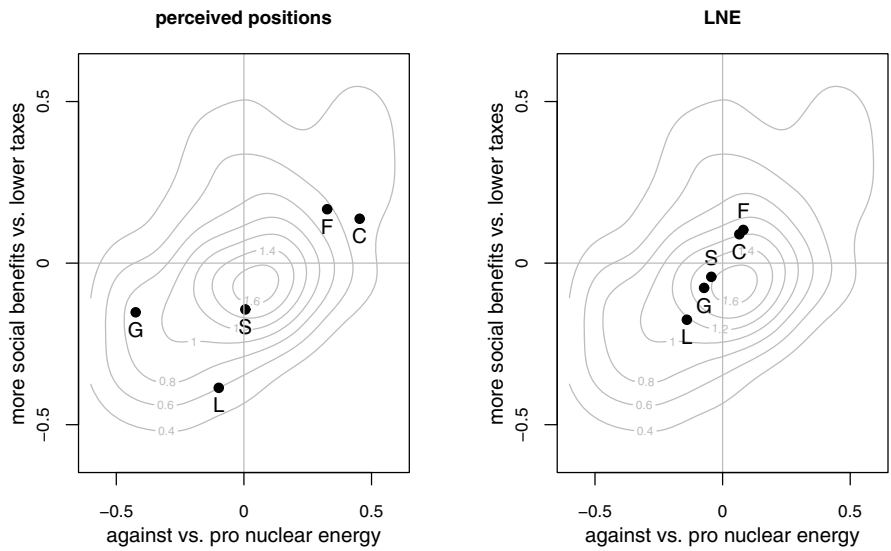

Figure 7. Voter distribution and party positions regarding nuclear energy and taxes.

be positioned along one line in the three-dimensional policy space intersecting the joint electoral mean, which could indicate a principal component of the voters' preference distribution (e.g. Schofield, 2007: 972f.). This assumption is also supported by the shape of the contour lines of the voter distribution that indicates that most voters are distributed along this line from the lower left quadrant to the upper right quadrant of the policy space intersecting the joint mean.

The simulated equilibrium configuration is still very centrist when compared with the configuration of the rescaled mean perceived party positions. One possible explanation for the pattern that is perceived by the electorate is that there are activist groups that pull the party positions more to the extreme points of the dimensions, as discussed in Schofield (2006). As we have already shown in Figures 3 and 4, the peak of the ideal point distribution of the parties' partisans is in all cases as extreme or even more extreme than the mean perceived position of the respective party regarding the distinct policy issue dimensions. If we assume that partisans act as party activists, for example, by putting more effort into persuading their acquaintances to vote for their party the closer the party's policy is to their own preference, then they generate additional valence for the party, depending on the distance to the party's policy position. Because the partisans' ideal points are distributed more towards the extreme of the policy scales than the ideal points of other voters, this mechanism serves as a pull factor towards extreme positions, as opposed to the pull factor towards the center of the distribution, which is generated by the external valence term. According to Schofield (2006) the parties take positions which balance the electoral and the activists' pull effects in order to maximize their vote shares. As we do not have any information on the concrete form of the activists' valence function, we can only guess that this is the missing feature in the model that explains

the remaining discrepancy between the simulated LNE and the configuration of the mean perceived party positions.

6. Conclusion

In this paper we have combined ideological and policy distances with valence within a formal model of party competition that can be applied to the German party system at the 2009 election. We choose the valence model developed by Schofield to be the base of our analysis, and extend it by fixing the ideological dimension, arguing that parties are not able to alter their positions on the ideological left–right dimension in the short term. Thus, separate coefficients for the influence of ideological and policy distances on the vote decision are estimated. The results of the equilibrium analysis show that fixing parties' ideological position in a simulation procedure leads to a much more realistic and stable equilibrium configuration as does the model in which parties are assumed to adjust their left–right positions without constraints.

In addition, when assuming that the policy space is only defined by concrete issue dimensions, the unrealistic configuration in which all parties locate at the joint electoral mean proves not to be an equilibrium in the German 2009 election. Rather, all parties take positions along a diagonal intersecting the joint mean in an ordering that corresponds to their perceived left–right position. This line could possibly mark a principal electoral axis of the policy space, at which the voters' ideal point variance is largest.

These results show that it is crucial to tie party positions to a meaningful ideological component in order to achieve a realistic model of party competition. We defined this anchor to be the left–right positions of parties. Another possibility could be to include party identification in the utility function of the voters, as done by Erikson and Romero (1990) or Adams (2001); Adams et al. (2005). This also could constrain parties' maneuverability in the policy space. In fact, our unstable equilibrium results produced by the model where we do not fix left–right positions resemble those of the policy-only model of Adams et al. (2005), whereas fixing left–right positions leads to similar equilibrium configurations as the unified model of Adams et al. (2005) predicts by including party identification. This clarifies the importance of a stabilizing element in the voter's utility function for stable equilibria.

The equilibrium configuration we found is still more centrist than the actual perceived party configuration. A possible explanation for this discrepancy is that parties' valence terms may be affected by activists, as already argued by Schofield. Yet, to the best of the authors' knowledge, a specification of this activist valence function has not been available in the literature up to now. Therefore, the balance theorem as stated by Schofield (2006), which would allow to analyze the activists' pull on the party positions, cannot be tested in this paper. We can only suggest that it is the more extreme position of partisans' policy ideal points that influences the parties to take more extreme positions than predicted by the model that only includes external valence.

It is worth mentioning that an inclusion of an activist valence function in the model is just another way of including policy motivation. The inclusion of an activist valence function still assumes parties to be solely office seeking, but maximizing vote share in this extended model means considering policy preferences of other actors. We argue that those other actors would be parties' partisans, who create valence by advertising the

party among their acquaintances. It could also be assumed that those activists are party supporters donating time and money for the electoral campaign (cf. Schofield and Sened, 2005a). This topic offers much potential for future research.

There are two further limitations to this study that should be mentioned. First, using party constants as valence measures is clearly not the best solution, as the unrealistic estimate of the Linke's valence reveals. Valence can be measured more directly, as Schofield et al. (2011a) have already shown for British parties. The second limitation is that the model is not sensitive to issue ownership. For example, it predicts that the Greens would take a more moderate position regarding the nuclear energy issue dimension. However, considering the finding by Adams et al. (2006) that niche parties are being punished when moderating their policy positions, it seems safe to say that pursuing this kind of behavior would be unwise for the Green party, especially since it became prominent by promoting an extreme (anti-nuclear) position in the first place. Ideally, one should modify the spatial model by fixing only an issue position of a certain party if one has good criteria to measure issue ownership. But fixing too much would mean giving up the major insight of spatial models of party competition, which is that parties offer policies to improve their electoral chances. On the other side, their flexibility is constrained by the difficult communication with an inattentive electorate.

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Notes

1. 'borrowing a term from Kurt Lewin let us call "valence issues" those that merely involve the linking of the parties with some condition that is positively or negatively valued by the electorate' (Stokes, 1963: 373).
2. See the German Longitudinal Election Study, pre-election cross-section survey 2009, ZA no. 5300, doi: 10.4232/1.10997.1
3. CDU and CSU form one parliamentary party in the *Bundestag* and are therefore treated as one party, which we label CDU for the sake of convenience.
4. The percentage of respondents who are classified as having a correct transformation coefficient regarding the perceived party positions is 96% with respect to left–right, 95% concerning the nuclear energy issue, 85% concerning the immigration issue and 73% concerning the issue question on more social benefits versus lower taxes.
5. This applied to 43 respondents regarding the tax issue, 30 respondents regarding the immigration issue, and 97 respondents regarding the nuclear energy issue.
6. Further analyses showed that this could be due to contradictory tendencies between ideological and policy dimensions. If only ideological distance is included in the vote model, the conditions of the mean voter valence theorem are not fulfilled, indicating that there are centrifugal tendencies on this dimension. However, if only policy distances are included in the

vote model, the mean fulfills all necessary and sufficient conditions of the theorem, suggesting that on these dimensions there are centripetal tendencies in the party system. The results of these analyses are available upon request from the authors.

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