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Johannes Schmitt & Simon T. Franzmann:

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A Polarizing Dynamic by Center Cabinets? The Mechanism of Limited Contestation

Johannes Schmitt & Simon T. Franzmann *

Abstract: »Eine polarisierende Wirkung von Zentrumskabinetten? Der Mechanismus der eingeschränkten Konkurrenz«. What effect does the presence of a coalition of the ideological center have on polarization in party systems? Studies of party positioning demonstrate the impact of a party's affiliation to the cabinet for its electoral campaigning. In addition, comparative studies of party systems analyzed the effects of the competitive situation between the coalition and the opposition on party competition dynamics. Nevertheless, the linkage between findings of both branches of literature is still missing. On the one hand, studies of party competition models generally focus on explaining party behavior and do not aggregate these insights. On the other hand, party system studies usually lack an analytical micro-foundation. Thus, we do not know the mechanism that drives a polity to the extreme. To find this missing link, we derive two potential explanations based on the spatial theory of party competition and Satori's study of party systems: incumbent punishment and limited contestation. We elaborate these mechanisms with the help of an agent-based model. Then, we trace the effect of cabinet type back to the limited contestation between coalition parties. If the incumbent parties avoid contestation with each other, a center cabinet induces polarizing dynamics since the opposition then has no incentive for responsible office-seeking. Specific circumstances such as a polarized electorate and voters' negative evaluation of the cabinet parties support this mechanism. Methodologically, our simulation study reveals three advantages of the agent-based modeling approach: (1) the uncovering of thus far implicit assumptions; (2) the possibility of analyzing causal dependencies within a complex and dynamic model; and (3) the precision of our theoretical expectations based on the micro-foundation.

Keywords: Party competition, party system polarization, agent-based modeling, polarized pluralism.

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1. Introduction¹

What impact has the competitive situation between government and opposition on party system polarization? What kind of government-opposition structure, e.g. a center vs. a wing cabinet, leads to a centripetal dynamic and when does a polarizing momentum arise? Many studies on party competition taught us the importance of party's affiliation to the cabinet for its electoral campaigning and, in consequence, for their positioning along the competitive dimension (Fagerholm 2016, 505; Meyer 2013). Moreover, comparative studies also show us the effect of different competitive situations on polarizing dynamics in party systems (Curini and Hino 2012; Schmitt and Franzmann 2017a; Sartori 1976). Nevertheless, there is a missing link between findings of party competition models and studies of party systems. In recent years, political science literature has made major advances in explaining the positioning of parties (Adams 2012; Fagerholm 2016). However, this branch concentrates rather on the behavior of single actors. Consequently, the aggregation of these patterns of party behavior to the system level is rarely the point of interest. On the contrary, comparative studies of party system polarization usually focus on macro-level patterns without an explicit derivation of actor-based explanations (e.g. Sartori 1976; Powell 2015).

For this reason, our explanation of polarization dynamics based on actors' behavior is, so far, incomplete and we are confronted with a so-called 'black-box.' There are two different branches of literature whose findings have not been linked to each other yet. Our article, at least partially, fills this gap by relying on an agent based model (ABM). We argue that this method is an appropriate tool to connect macro-level dependencies with micro- (or meso-) level mechanisms. Therefore, we are able to link both branches of literature.

For this purpose, we integrate findings of party competition models in the tradition of the spatial theory (Downs 1957) and considerations of Giovanni Sartori into our model. Sartori had fundamental ideas on the macro-level dynamics of party systems. His typology is still an essential innovation in the research area of party systems (Mair 1997, 206; Evans 2002), but neglects to identify clear mechanisms of micro-level party behavior. We demonstrate how ABM is able to combine the strength of the modern micro-level oriented empirical explanations with the classical literature on party system types.

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The aggregation of individual party positioning to party system polarization is of great interest to explain party system stability and representation. Generally speaking, polarization indicates the level of diverging opinions within a party system or a political system. The more there are diverging opinions, the more difficult it is to find a majority (Schmitt and Franzmann 2017b, 3). Polarization put to its extremes threatens the function of a political system as a whole (Sartori 1976), while a moderate increase might have a positive impact on voter turnout (Dalton 2008). In this article, we are rather interested in party system mechanisms.

Three potential advantages of ABM become visible: (1) So far, the formal modeling approach has revealed the implicit assumptions and axioms of the verbal theory. As a necessity of an ABM's application, all theoretical arguments are explicitly formulated and the intersubjective traceability of the theory increases. (2) Based on an ABM, it is possible to analyze causal dependencies and links between analytical levels within a dynamic multi-level model. Therefore, we can test whether a mechanism on the party or voter level explains the impact of a center coalition. This analysis ensures the logical consistency of our theoretical argumentation even though the theoretical model becomes complex. In addition, the comprehensibility of ABMs is possible because of their realization in an established programming environment (Wilensky 1999). Interested researchers can easily understand and manipulate a model's properties. Therefore, in our opinions, ABMs are better accessible than comparable mathematical models. (3) And lastly, we adjust our empirical expectations based on theory. Hence, we can formulate empirically, testable hypotheses in a more sophisticated way than before. In particular, the conditions for the influence of center cabinets are made visible. We illustrate the crucial change in evaluating empirical patterns, which became visible by using ABMs. This advantage might be the most concrete one regarding a theory-testing research design because of its critical impact on empirical analyses.

We start by discussing current literature on party system positioning and polarization. Based on these models of party competition and Sartori's typology, we outline our theoretical model. The central explaining mechanisms we identify are (1) the limited contestation between coalition partners and (2) voters' tendency to punish incumbents in the case of dissatisfaction with the government. Then we develop the ABM in detail. Finally, we analyze a sample of runs of the model both. The results of the ABM provide essential information about the theoretical framework. We show that there is no simple, linear relationship between cabinet-opposition patterns and polarization. A coalition of the ideological center only affects the competition dynamic under specific circumstances and the ABM significantly expands our knowledge about these dependencies. Based on the simulation results, we argue that a center cabinet is an insufficient but necessary part of a condition, which is itself unnecessary but

sufficient (or an INUS condition; Mackie 1965) for the occurrence of a polarizing dynamic in party competition.

2. Party Positioning and Party System Polarization

In the tradition of the spatial theory, party positioning is explained by two fundamental assumptions in its simplest form (Downs 1957): parties try to maximize their votes and voters vote for the party that represents their policy preferences best. Furthermore, the reducibility of policy preferences to one dimension is usually surmised. Regarding a two-party competition, we would assume a party positioning around the median voter based on this model. Of course, the so-called median-voter theorem does not hold true in empirical studies (for a review Martin 2009, 47-9). However, this original model initiates a great number of further developments and follow-up studies. These innovations provide the starting point of our analysis. The original model of Downs denies any influence of the cabinet type (or something like that) on the competition dynamics. However, the findings and model modifications of the following studies give us potential hints to the mechanism we are looking for. In spite of the many insights of the party positioning literature the impact of the competitive situation between government and opposition on party system polarization is still unexplained. In the following, we discuss the branches of the literature of party competition studies. Building on this, we have identified at least seven major modifications on Downs' basic model.

First, scholars doubt that positions on all issues are disputed in party competition (Stokes 1963). They stress the importance of issues in which parties share the same goal. Parties rather compete for being perceived as the most competent one. Stokes (1963) labeled those issues as "valence issues." Because all parties hold the same position, voters cannot decide on policy-oriented considerations. Already Downs (1957, 50) stressed the importance of the government record for the voting decision, but the overall idea of a competition on competence is not part of his study.

Second, political parties do not follow a strict vote-seeking strategy. At least, parties' calculus comprises simultaneously vote-, policy-, and office-seeking (Strøm 1990). Agent-based models have already shown that the pursuing of different goals influences parties' willingness to compromise and, in consequences, has an effect on the competition dynamic (Franzmann and Schmitt 2016).

Third, parties might not act in the same policy spaces. The work of Robertson (1976) prepared the later development of the salience theory of party competition. Here, we assume that parties selectively emphasize different issues, instead of competing each other along position issues. Furthermore, parties can own specific issues. This consideration reflects the idea of valence issues

(Budge and Farlie 1983; Budge 2001; Budge 2015). Relying on this idea, Budge (1994) proposes in his “new spatial theory of party competition” five models of party positioning. In contrast to Downs, Budge (1994, 461) does not assume that parties are simply vote-maximizers. Depending on the competitive situation, they react, for example, to past electoral results, alter their position based on their leadership or try to hold distance to their ideological rivals. This study inspired a lot of work on party positioning (Adams 2012; Fagerholm 2015). For instance, Adams and Somer-Topcu (2009) observe that parties move into the direction of a rival party that has successfully moved in the election before.

The fourth modification focuses on the difference between mainstream and niche parties. Niche parties are not keen on moving towards the center. They are sensitive to shifts in the median policy position of their voters but do not systematically respond to the median voter position in the general electorate (Adams et al. 2006; Ezrow 2008; Ezrow et al. 2010).

Fifth, the assumption of a party as a unitary actor is abandoned. Focusing on the internal organization, Meyer (2013) shows that parties with strong organizations can more easily change their policy positions. Furthermore, the greater the power of party members compared to the party leadership, the less likely are position and issue changes (Schumacher et al. 2013; Hennl and Franzmann 2017).

Sixth, the government and opposition status have an impact on party behavior. Meyer (2013) and Schumacher et al. (2013) demonstrate that left-right policy change is easier for parties in government. In contrast, Hennl and Franzmann (2017) show that issue salience change is easier for parties in opposition. However, these studies do not question whether the cabinet type modifies incentives for changing party positions.

Seventh, ABMs of party competition are developed to model dynamics of multi-party systems (Laver 2005; Laver and Sergenti 2012; Fowler and Laver 2008). In these models, parties act as adaptive actors and different party strategies are implemented. In addition, researches use computational methods to model various, complex assumptions. For example, Smirnov and Fowler (2007) analyze the impact of uncertainty and Bayesian learning in a two-party competition. They show how the interdependence between two policy-motivated parties may lead to a more extreme or moderate positioning. Furthermore, polarization is formally approached for two-party legislatures (Merrill et al. 2014; Brunell et al. 2016).

In sum, studies of party positioning show a wide range of innovations. These modifications may hold a mechanism to explain cabinet’s type influence on the polarization dynamic. For example, non-policy based considerations in the voter calculus might reflect the perception of the government record. Pursuing different goals and parties’ different roles can lead to varying strategic choices and may result in a more extreme or moderate positioning. However,

these findings are related to the meso-level. Up to this point, we do not explain the output of the entire system – the sum of the party positioning. The exceptions are the few ABM studies on party competition, where the point of interest is shifted to the party system as a whole.

In contrast to the party competition literature, comparative studies on party systems concentrate on macro-level dependencies. Yet again, one of the central innovations is still the work of Sartori (1976). To analyze party system dynamics, Sartori (1976) introduces the idea of party system mechanics. He argues that fragmentation and ideological polarization characterize the nature of a party system. Polarization is defined as “an ideological distance, that is, the overall spread of the ideological spectrum of any given polity [...]” (ibid., 126). Therefore, “[we] have polarization when we have ideological distance [in contradistinction to ideological proximity]” (ibid., 135). Party systems characterized as a type of “polarized pluralism” reveal a centrifugal party system mechanic. This dynamic can lead to a breakdown of the whole political system (Sartori 1976, 131-41). In contrast to polarized pluralism, “moderate pluralism” shows a centripetal dynamic as predicted in Downs’ example of a two-party system. The literature on polarization discusses the commonly adverse influences of a high ideological polarization. Correlations with cabinet survival, political stability, and other characteristics of political systems have been confirmed by empirical analyses (for a review, see Curini and Hino 2012, 460-1; Dalton 2008). What is currently missing in political science literature is a combination of the party positioning literature, which concentrates on dynamics at the micro-level in multi-party systems, and the polarization literature, which focuses on macro-level dynamics. In the following, we combine both perspectives in order to explain party system dynamics on both micro-and macro-level in multi-party systems.

3. Two Potential Mechanisms: Limited Contestation and Incumbent Punishment

In this section, we combine the different branches in the literature discussing party system dynamics in order to develop a model for explaining polarization. We argue that limited contestation between parties as well as incumbent punishment are the mechanisms that evoke polarizing dynamics.

Regarding the actor level, we assume that parties act rationally in the sense that they maximize their utility. They try to take a position within the ideological space that promises the highest utility for themselves. Parties have information about the consequences of positioning ϕ ideological points to the left and right of their current position. Within this range, parties choose the current best position for themselves – the position that involves the highest utility. Referring to Strøm (1990), we model three different party goals:

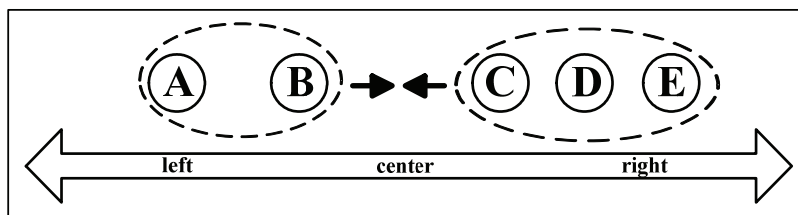
vote-seeking (ϑ_p), office-seeking (o_p), and policy-seeking (ρ_p). Therefore, party p's utility (U_p) to position on a particular ideological position (Δ) is given by the following formula. The weight factors β_1 , β_2 , and β_3 describe a party's different weighting of its goals.

$$(Eq. 1) \quad U_{p\Delta} = \beta_1\vartheta_{p\Delta} + \beta_2o_{p\Delta} + \beta_3\rho_{p\Delta} ; \text{ where } \beta_1 + \beta_2 + \beta_3 = 1$$

The vote-seeking utility is simply determined by parties' vote share ($\vartheta_p = \frac{N_{vp}}{N_v}$) and the policy-seeking utility is the distance of the current taken position to preferred position divided by the maximal possible distance ($\rho_p = 1 - \frac{|\Delta_p - \mu_p|}{100}$). Thus, the highest policy-seeking utility ($\rho = 1$) is obviously achieved when the party takes its preferred position. The office-seeking utility of a party is determined by its necessity for potential cabinets. Thus, the office-seeking behavior is aimed at maximizing a party's relevance in the post-election coalition formation process.

This party rationale is fully compatible with Sartori's argument on what drives party system dynamics (Sartori 1976, 340-7). Two interlinked conditions are decisive in explaining these dynamics of party competition: the *pattern of opposition* in combination with the *occupation of the ideological center*, both resulting from the type of cabinet. As long as the ideological center is not occupied, parties will try to attract voters at the ideological center, namely the median voter. Consequently, the competition dynamic is centripetal and directed towards the center. Figure 1 illustrates such a situation within a five-party system.

Figure 1: The Centripetal Shift without an Occupied Center

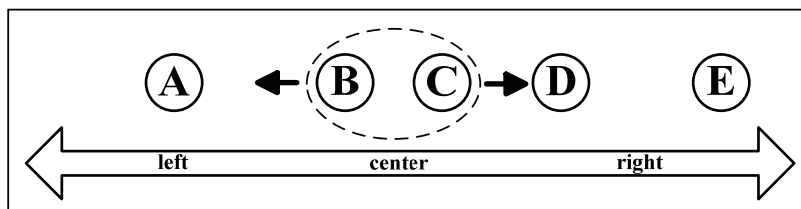


Source: Schmitt and Franzmann 2017a.

Parties A and B form a coalition on the left side of the ideological spectrum. From now on, we will call this a "wing cabinet." The opposition is formed by C, D, and E. All these parties belong to the opposite side of the ideological spectrum – the right side. We can see unilateral opposition from one direction since no relevant party exists to the left of the coalition government. If the opposition's aim is to replace the present government after the election, the crucial votes will be located at the ideological center. As a result, competition between the two "teams" and a centripetal dynamic arise.

The opposite situation – a party system featuring polarized pluralism with centrifugal competition dynamics – is illustrated in Figure 2. The initiating competitive situation is characterized by the fact that the governing coalition is challenged by parties from both ends of the ideological spectrum. In this circumstance, the cabinet “occupies” the ideological center, which “implies that the central area of the political system is out of competition” (Sartori 1976, 135). Thus, left- and right-wing voters constitute the contested voter populations during the electoral campaign. An ideological heating shapes this party competition, because no party’s strategy involves attracting voters at the ideological center. In consequence, the result is a continual undermining of the center parties’ electoral support. The opposition parties (A, D, and E) contest the coalition parties (B and C). The arrows symbolize the direction of the competition. Based on this theory, we expect a centrifugal push from this government-opposition pattern.

Figure 2: The Centrifugal Push of Center Cabinets



Source: Schmitt and Franzmann 2017a.

However, Sartori presents no causal mechanism, just a description of the general pattern of the direction of competition. His type of polarized pluralism orients on historical examples such as the Weimar Republic and the Italian party system. How can we trace this pattern back to a mechanism based on a behavioral theory of both parties and voters? We have to think about which types of interaction could potentially create such a mechanism. The basic types of party competition are contest and cooperation. Cooperation occurs when two parties have similar goals and show solidarity, while contest results from a zero-sum game where a gain by one party leads to a loss by the other (Franzmann 2011, 320-2). In Figure 2, the coalition parties (B and C) do not contest each other in the fight for the median voter. They cooperate in order to be re-elected as a coalition. We call this mechanism *limited contestation* since a decisive battle for center votes is absent. Theoretically, it is possible that the center cabinet partners will not cooperate during the next electoral campaign. In that case, such a centrifugal push will not necessarily be present.

If this mechanism is present and center cabinet parties avoid fighting for the median voter, it also has a tremendous impact on the opposition parties’ behavior. They are restricted in their goals. These parties cannot expect to form a

post-electoral coalition with recent cabinet parties. Hence, their opportunities to achieve their office-seeking goals are limited.

This line of reasoning can be illustrated by the opposite situation. Within a party system with a wing cabinet, as portrayed in Figure 1, the opposition is still able to form an alternative “team” that can potentially win elections and form a post-electoral coalition. Hence, the opposition still pursues its office-seeking aims. Furthermore, the decisive votes to win the election are placed at the ideological center for both teams. For example, when a (left-wing) coalition (e.g., Figure 1, parties A and B) and the ideologically homogeneous (right-wing) opposition (e.g., parties C, D, and E in Figure 1) cooperate within their own groups and both try to win the election, they have to attract contested voters around the ideological median position.

In Figure 2, featuring polarized pluralism, the opposition is split up into two ideologically separate groups in a party system with a center cabinet. Because of their ideological differences, they do not represent a serious alternative to the governing cabinet (Sartori 1976, 134). Each group of opposition parties may not be capable of winning the majority in the election. In this situation, opposition parties are not able to pursue any of their office-seeking goals. This is particularly interesting because office-seeking objectives commonly result in more moderate positioning. The reason for this is that ideological differences to other parties lower party’s coalition potential. As a consequence of the prevention of office-seeking opportunities, opposition parties concentrate solely on policy- and vote-seeking goals when a center cabinet is present. This eventually leads to increasing polarization instead of competition for the median voter.

While this is a mechanism based only on party behavior, a second hypothetical mechanism relies on the voter-party relationship. Party democracies rely on responsiveness and accountability: Parties should be responsive to voters’ demands, and parties have to be held accountable for their courses of action. In order to guarantee accountability, voters can use their vote in the next election and sanction or reward parties (Bühlmann and Kriesi 2013). Consequently, voters can punish the government by voting for the opposition. In consequence, the opposition may become the future government and be held accountable in the following election. However, as discussed, in polarized pluralism opposition parties have no chance to participate in government. Consequently, accountability is of no concern for them.

Contrary to that, everything else being equal, within a party system with a wing cabinet, a dissatisfied voter has a moderate alternative. Referring to the outlined examples (see Figures 1 and 2), a dissatisfied voter of party B in Figure 1 can switch to the moderate alternative party (C). In contrast, a dissatisfied voter in Figure 2 may shift to the non-moderate parties (A or D). Hence, penalization of the cabinet by voters in combination with the government-opposition patterns cause a centrifugal dynamic due to the changing voting behavior. This

dynamic persists since the opposition has no real chance to get into power. In the following, we call this mechanism *incumbent punishment*.

We integrate this idea in the proximity voting calculus of spatial theory. The received utility of voting for a party results from the distance to the party, or, in other words, the utility U of voter v to vote for party p amounts to the negative, ideological distance to this party:

$$(Eq. 2) \quad U_{vp} = -|\Delta_p - \Delta_v|$$

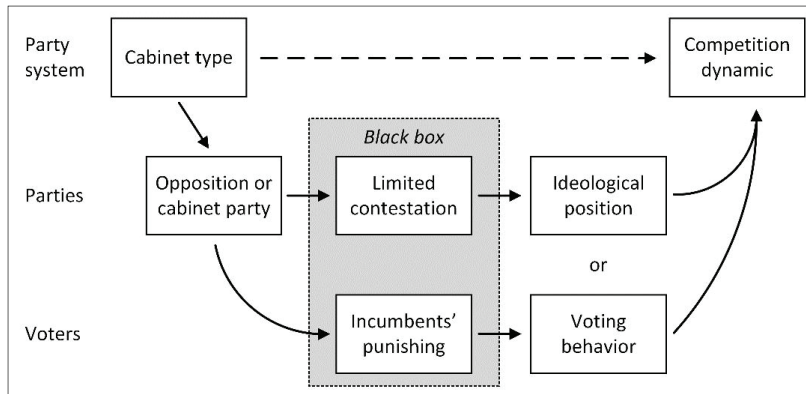
Hence, the voter receives the highest utility by voting for the party with the lowest distance from their own ideological position. This voting model is often criticized because of its simplicity. In fact, empirical models based on the Michigan model (Campbell et al. 1954) include more variables to explain voting behavior, e.g. party identification and candidate evaluation. In recent studies of agent-based party competition models, these non-policy factors were also included in the voting heuristics (e.g. Laver and Sergenti 2012; Plümper and Martin 2008). These analyses show that such factors can have a striking effect on the competition dynamic. For example, Plümper and Martin (2008) show that party identification of specific voters can trigger a centrifugal push without any voter polarization present. To consider these insights, non-policy voting considerations were added to the voting heuristic. Therefore, we could control whether the effect of the cabinet type presupposed any assumption about non-policy voting motivations within the electorate. This factor was simply included in the primary voting model (Eq. 2):

$$(Eq. 3) \quad U_{vp} = -|\Delta_p - \Delta_v| + \varepsilon_{vp}$$

A positive evaluation increases the utility for voting for this party, and vice versa. In an extreme case, it can be so strong that the voting decision is determined independently from the parties' positions. However, we do not make any assumptions about the origins of these non-policy evaluations by voters. In the model, we considered only two assumptions: (1) there are different types of possible distributions (outlined below) and (2) this factor is time-invariant during the election campaign – with one exception. Incumbent punishment is realized as a time-dependent malus based on voters' negative evaluation of cabinet parties.

With these two mechanisms, we have added a behavioral perspective to Sartori's (1976) classical approach. In his milestone work, Sartori does not link his argumentation with specified assumptions about party positioning or voting behavior. The so-called "black box" is now filled with behavioral mechanisms (Hedström and Ylikoski 2010, 51-3). We used Coleman's (1994) macro-micro-macro model to outline the problem within the explanation (Figure 3).

Figure 3: The Black Box of the Theoretical Framework



When we assume that the cabinet type causes a different competition dynamic, the specific distribution of the cabinet membership within inter-party competition has to have an influence on the positioning or voting behavior of any actor. The two outlined mechanisms are the conceptual base of our ABM. Both offer potential explanations for the influence of center cabinets on the competition dynamic. Strictly speaking, this step does not represent a theoretical deduction because of the missing precision of the axioms and assumptions. We formed a conceptual basis for the ABM. The systematic micro-foundation and integration of precise, formal assumptions are covered in the following section.

4. The Agent Based Model

In this section, we outline the ABM. First, we explain why we rely on this method. Then we explain the parties' as well as voters' calculus. Relying on different types, we implement the two mechanisms outlined above. The outcome is party system polarization.

ABMs are certainly not in common use in social science (de Marchi and Page 2014; Squazzoni 2010), and there are crucial differences between them and other analytical (game-theory) models (de Marchi and Page 2008; Laver and Sergenti 2012, vi-xii) and other computational approaches (Gilbert and Troitzsch 2005). Two central characteristics of the modeling approach are most important for comparisons with alternative methods of model building: the agent-oriented perspective and the computational approach (e.g. Gilbert 2008; Railsback and Grimm 2012, 9-12).

Regarding an object-oriented logic, actors are autonomous objects of a defined class with independent states embedded in a context. Based on the programming language, there are vast opportunities to realize theoretical assump-

tions in the formal model, such as heterogeneous actors, proactive or reactive behaviors, and social capabilities. However, a core element of an ABM is its iterative function, which represents a dynamic process in contrast to analytical models. Therefore, actors' behaviors are rule based, and these actors must make decisions in defined sequences of action (Schmitt 2015).

Based on its advantages, the ABM approach is suitable for a (theoretical) analysis of macro-level outcomes of micro- and meso-level mechanisms in complex environments (Axelrod and Tesfatsion 2006, 1649-50). The application of this approach requires the implementation of several explicit and, so far, implicit theoretical concepts within the programming environment. We have to realize three major aspects for our ABM:

- 1) The general structure of the party system: What kind of ideological dimension exists? How many parties and voters are there? How are their ideological positions and preferences distributed?
- 2) The actors, their characteristics and their heuristics: How do parties position themselves on the competitive dimension and how do voters decide to vote for a party?
- 3) The general sequence of action: When do actors act? What is the order between the different actions, e.g. party positioning and voting decision? How often does the loop of actions iterate?

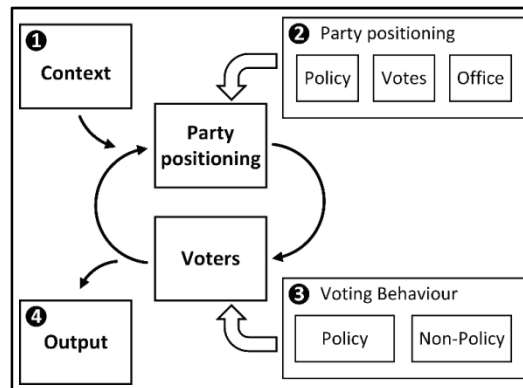
In the following, we describe each point to explain the structure of our ABM. First, we describe the general model, its loop, and its properties. Lastly, all model parameters, their variations, and the measured outcome are summarized. We realized the model in NetLogo. The implementation can be downloaded at our project home page² and all results can be reproduced based on the available software.

4.1 Overview

Following previous ABMs (e.g., Laver and Sergenti 2012) and spatial models of party competition, the basic structure of our model is relatively simple and represents an electoral competition before an election. Parties' positions in the left-right dimension are based on a utility function in sequences. Subsequently, voters rethink their voting choice. After a determined number of campaign turns, a simulation run ends and the patterns of competition produced by the interaction between voters and parties are measured. At the beginning, the existing cabinet type and other starting conditions are exogenously determined.

² <www.pruf.de/dfg-projekt-opposition> (Accessed January 16, 2018).

Figure 4: A Basic Loop of the Simulation Model



The first step of the model (starting conditions) implies the determination of the party system structure and is carried out before the first iteration of a simulation run. The next two steps represent the general loop of the ABM: Parties (re-) position on the left-right dimension (step 2) and voters choose their preferred parties considering the present circumstances (step 3). This sequence iterates many times. After the last iteration, the output – the change of polarization – is measured (step 4) and the simulation run ends. The analysis leans on many different simulation runs with varying starting conditions.

4.2 Context: The General Structure of the Party Competition

The modeled context of the party system represents the logical starting point of our ABM. The basic structure is defined by the main axis of ideological competition, the voter distribution, and the number of relevant parties. Of course, the electoral system is one of the most striking institutional features structuring party competition. Since we analyze multi-party competition, we assume a simple proportional representation system with a direct translation of votes into seats.

The ideological space is modeled as unidimensional and ranges from 0 to 100. In the tradition of Downs (1957) as well as political sociology (Inglehart 1984), we label this unidimensional space as a left-right axis. Literature on ABM (e.g. Laver and Sergenti 2012) and empirical studies of party competition (e.g. Kitschelt 1994) discuss the existence of an at least two-dimensional space. Nevertheless, empirical studies (e.g. Marks et al. 2006) demonstrate that the transformation of the European political space from a ‘pure’ economic one into a space that also covers a libertarian-authoritarian axis results again in a unidimensional solution. The difference is that economic and social issues merged into a new left-right dimension representing a country-specific combination of both axes (Inglehart 1984; Marks et al. 2006). A second dimension that cuts

through the main axis of party competition logically leads to a decrease of polarization. Consequently, we stick to the one-dimensional solution, because the specific kind of combination of economic and social issues is not relevant for our study.

Technically, we implement in NetLogo the ideological dimension with 101 so-called “patches.” Each patch is a defined number of voters (v) that possess this ideological position (Δ_v). Also, each party (p) has one unique position (Δ_p). In contrast to a party’s position, we model voter’s ideological position as time-invariant during the same electoral cycle. Of course, in real-world electoral campaigns, we will observe endogenous preference formation processes. Nevertheless, empirically ideological positions are relatively stable (Van der Eijk et al. 2005). In a pre-test of our ABM, we included an endogenous preference formation within the electorate (Schmitt 2014). It reveals that different assumptions about such a preference formation process do not affect our analyzed dependency. Thus, we forgo to model the flexibility of voter preferences to reduce model’s complexity.

Regarding the voter distribution at the aggregate level, two ideal types are of particular interest for us: unimodal and bimodal distributions. Although other distributions are discussed in the literature (e.g. Caramani 2008, 341-2), this study focuses on the two ideal types. Regarding polarization, voter distributions should evoke different dynamics. All else being equal, a bimodal distribution creates incentives to compete for relatively more extreme voters, whereas a unimodal distribution supports competition for the median voter. Furthermore, the standard deviation of both distribution types can vary. Thus, different nuances can be mapped within the models. The advantage of this procedure is that the voter distribution can be captured by just two parameters in the model. Like the voter distribution, the number of voters is also determined before the very first iteration of the simulation run. The concrete number of voters is not relevant for the simulation dynamics. Only if there are very few voters, the number influences model’s dynamics because the distribution is not represented correctly. For example, fifty voters can only present partly a normal distribution on a 101-point scale. However, Schmitt (2014) has demonstrated that if the number exceeds a thousand voters, there will be no effect. Hence, we fixed the number of voters at one million.³

The number of parties varies between 3 and 10. This number is also exogenously determined and invariant during a simulation run. Logically, we need at least three parties to generate the possibility of a central government with a bilateral opposition. In the following subsections, we discuss how the mecha-

³ Regarding the concrete technical realization, one million objects in NetLogo would require high computational resources. To avoid this problem, each patch represents a set of voters to minimize the computing time. This is possible because voters on the same ideological position do not differ from each other.

nisms of limited contestation and incumbent punishment are implemented given the context of party competition.

4.3 Implementing the Mechanism of Limited Contestation

As discussed above, we assume that parties act rationally in the sense that they maximize their utility regarding vote-, office-, and policy-seeking goals. In our model, each party's starting position on the left-right scale is randomly assigned. From this starting position, parties try to find a place within the ideological space that promises the highest utility for themselves. They have information about the consequences of positioning ϕ ideological points to the left and right of their current position in each iteration. Within this range, parties choose the current best position for themselves – the position that involves the highest utility. In each iteration, each party can reposition one time. At that time, the party has the information about the present positions of the other parties and the voter preferences. The order of action between the parties is selected randomly in each iteration. Furthermore, the information capacity ϕ varies between simulation runs and is equal for all parties within the same run (see Table 1).

The cabinet affiliation determines whether a party is part of the present cabinet or not. This factor is exogenously determined at the beginning of a simulation and is also time-invariant. The following three attributes are necessary for a party's pursuit of its three different aims: (1) The party's current hypothetical vote share, which unsurprisingly represents recent voter support as a proportion that can change after each repositioning and varies between zero and one; (2) coalition potential, which represents the number of potential post-election cabinets in which a party's membership is necessary; and (3) ideological preference, which represents the party's actual preferred position in the ideological dimension. To sum up, purely vote-seeking parties act based on their vote share, office-seeking parties only orientate themselves according to their coalition potential, and policy-seeking parties take their preferred ideological position.

The office-seeking utility of a party is determined by its necessity for potential cabinets. This theoretical argument is realized as follows in the model: In each iteration, each party forms a hypothetically connected, minimal winning coalition (Axelrod 1970), of which it is a part. This coalition represents the current favored cabinet of the party. If a party is potentially able to form a cabinet without any other party's support, it forms a hypothetical one-party cabinet instead of a coalition. A party reaches the highest utility when it is required for all n post-election cabinets. Hence, we calculated office-seeking utility as the proportion of a party's involvement in these cabinets ($o_p = \frac{N_{\theta p}}{N_{\theta}}$).

In order to implement the mechanism of limited contestation, we modified cabinet parties' office-seeking utility. The basic idea of limited contestation is that the affiliation with the cabinet shapes parties' behavior. Cabinet parties cooperate within their coalition and contest opposition parties. This assumption is realized in two ways: (1) Parties in a coalition do not try to win votes at the expense of another coalition party. Thus, they try to win the election as a team. (2) In addition, coalition parties do not pursue the formation of an alternative coalition with opposition parties after the election.

Instead of maximizing their necessity in different potential cabinets, these parties try to maximize the current cabinet's chance of reelection. We measured this chance by the sum of a cabinet's vote share. When limited contestation is present in the model, the utility of a cabinet party is the sum of the cabinet's vote share multiplied by the party's office-seeking utility. Furthermore, cabinet parties are not part of the potential coalition bargaining of opposition parties.

In the course of developing the ABM, a further question arose: How do non-contesting cabinet parties choose between positions with the same utility? This frequently happens in runs with limited contestation.

Two different solutions were implemented: (1) Parties decide on the basis of their own vote- and/or policy-seeking utility depending on the weighting of these goals. Thus, a partial contestation between cabinet parties is possible when the electoral strength of the cabinet does not drop. We call this first type *partial contestation*. (2) As an alternative, cabinet parties additionally try to reduce the ideological discrepancies within the cabinet. Thus, if the utility of the two positions is equal, the party chooses the one with lower intra-cabinet variance in ideological positions. We call this second type *avoiding cabinet contestation*.

To summarize, in our ABM parties decide autonomously based on (1) their ideological positions taken Δ_v , (2) their cabinet affiliation τ_p (); (3) their current hypothetical vote shares (ϑ_p); (4) their coalition potentials (σ_p); and (5) their ideological preferences (μ_p).

4.4 Implementing the Mechanism of Incumbent Punishment

At the end of each iteration, voters choose their current preferred party. The voter calculus is discussed above. Consequently, we assume that voters know the present positions of all parties. In order to implement the mechanism of incumbent punishment, we add two modifications to the classical voter calculus: (1) non-policy evaluation of the parties and (2) the favored party. First, non-policy evaluation is a vector with a length equal to the number of parties ($\bar{\epsilon}_v$). Each value represents the evaluation of one party by the voter (ϵ_{vp}). A positive value represents a positive non-policy evaluation, and vice versa. Second, the voter's favored party (α_v) represents the party that they would elect if the election was held now. The favored party is chosen by the voter after each

repositioning of a party. Thus, the favored party can change more than once per iteration.

When testing the potential effects of this non-policy factor, the following distributions occurred in the model. The different distributions vary randomly between runs and are exogenously determined. In addition, the strength of the non-policy factor is determined by a further model parameter (E, see Table 1).

- (1) *Non-policy factor distribution type I (none)*: All parties are evaluated by all voters with a value of zero ($\epsilon_{vp} = 0$).
- (2) *Non-policy factor distribution type II (random)*: In this scenario the evaluation rests upon a random draw. This draw is based on a normal distribution with a mean of zero and a standard deviation of the defined non-policy weight (E). Because of the high number of voters, all parties have more or less the same evaluation bonus within the electorate. Furthermore, this bonus is uncorrelated with the positions of parties and voters.
- (3) *Non-policy factor distribution type III (distance-based)*: In contrast to type II, the voters' evaluation is not based on a random draw. It rests upon the starting distance of voters to the party. Referring to the non-policy weight (E), a voter v evaluates party p based on their positions Δ as follows:

$$(Eq. 4) \quad \epsilon_{vp} = \frac{50 - |\Delta_v - \Delta_p|}{50} * E.$$

As a consequence, a party with the same ideological position as the voter receives the highest evaluation ($+1 * E$) and a party with the highest possible distance receives the lowest possible evaluation ($-1 * w$). In this scenario, parties start in "their" voter population and both factors – ideological position and party evaluation – are highly correlated.

- (4) *Non-policy factor distribution type IV (distance-based, biased)*: This distribution type is identical to the former, distanced-based scenario with one exception. Each party has a random chance of 0.5 to gain a higher evaluation bonus from all voters ($\epsilon_{vp} = \epsilon_{vp} * 1.5$). Voter evaluation has a high inter-party variance. In consequence, there are parties with a positive and negative handicap.

The mechanism of incumbent punishment is implemented by changing voters' non-policy evaluation of *cabinet parties*. In every iteration, voters' non-policy factors of those parties decrease by the defined degree. This decreasing factor can vary between 1 and 25 divided by the number of iterations. Therefore, the chance of voting for a cabinet lowers step by step. In addition to the non-policy factor, voters' ideological positions are defined based on two input parameters: distribution type and standard deviation (see Table 1).

Figure 5: The Basic Model Structure

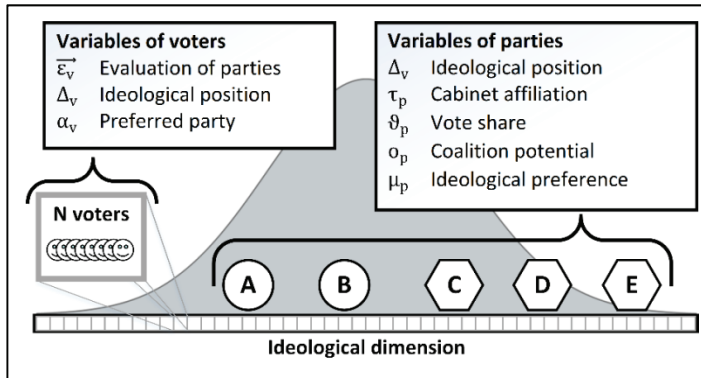


Figure 5 summarizes the basic model structure defined by the context, parties calculus and voters' calculus. It outlines a five-party system with a unimodal voter distribution and a wing cabinet (parties A and B).

4.5 Measured Outcome: Polarization

In the literature, different approaches to measuring party system polarization are frequently discussed (e.g., Sigelman and Yough 1978; Dalton 2008; for a review see Schmitt and Franzmann 2017b). The most common variants are the standard deviation, the range, or the mean absolute difference in parties' ideological positions. In addition to the different measurements of dispersions, authors also utilize different weighting concepts, e.g., weighting by parties' vote or seat share. In contrast to the empirical data, the differences between these measurements were relatively small within the simulation. For example, the correlation between the vote-share-weighted standard deviation and the range was 0.92. Hence, the choice of one of these indicators was not decisive. We chose the most common variant – vote-share-weighted standard deviation – to measure polarization (P):

$$(Eq. 5) \quad P = \sqrt{\sum_{p=1}^N (\vartheta_p * (\Delta_p - \bar{\Delta})^2)}$$

Polarization was measured before the first and after the last iteration. The competition (also called polarization) dynamic resulted from subtracting the first iteration polarization from the last iteration polarization (Dynamic = $P_{last} - P_{first}$). Therefore, a positive value of polarization means an increasing polarization, and vice versa.

4.6 Model's Parameterization and the Analyzing Strategy

In sum, 15 variables (or input parameters) were included in the model (see Table 1).

Table 1: Input Parameters

	Model parameter	Variation of random draw
Parties	Iterations	$x \in \mathbb{N}: 40 \leq x \leq 80$
	Random seed	$x \in \mathbb{N}: -2147483648 \leq x \leq 2147483647$
	Information capacity	$x \in \mathbb{N}: 1 \leq x \leq 5$
	Number of parties	$x \in \mathbb{N}: 3 \leq x \leq 10$
	Cabinet type	Wing or center
	Vote-seeking weight	constant, $\frac{1}{\text{sum of all weights}}$
	Office-seeking weight	$x = 0 \text{ or } 1, \frac{x}{\text{sum of all weights}}$
	Policy-seeking weight	$x = 0 \text{ or } 1, \frac{x}{\text{sum of all weights}}$
	Limited contestation (either type I or II) Type I: <i>partial contestation</i> Type II: <i>avoiding cabinet contestation</i>	Absence or presence
Voters	Voter distribution	uni- or bimodal
	Standard deviation of voter distribution	$x \in \mathbb{N}: 20 \leq x \leq 50$
	Distribution of non-policy factor*	Four different types: Type I: None Type II: Random Type III: Distance-based Type IV: Biased
	Non-policy weight	$x \in \mathbb{N}: 1 \leq x \leq 25$
	Incumbent punishment	Absence or present
	Punishment weight	$x \in \mathbb{N}: 1 \leq x \leq 25$

To compute all potential combinations, a huge number of repetitions would be required – particularly regarding all potential random seeds (approx. 85.4^{10} runs). Because of limited computational resources, a full parameterization (such as grid sweeping) (Laver and Sergenti 2012, 57-8) was not achievable. The alternative strategy was random parameterization (Izquierdo et al. 2009), in which overall validity can be estimated by test statistics, such as tests of statistical significance (p -values) and standard errors. Therefore, the value of each variable (or parameter) was randomly chosen at the beginning of a simulation run. After computing the iterations, the output of interest was measured. This process was repeated many times. Thus, the simulation model produced a

dataset where one case was one simulation run, and the (observed) dynamics of the ABM were thereby analyzed. A simulation based on random parameterization can be interpreted as a sample of all possible input variants of the model (the population).

In addition, all explanatory variables can be present or absent when testing counterfactual dependencies in the logic of an experimental design (Marchionni and Ylikoski 2013). Thus, this study uses inferential statistics and regression analysis to analyze the output data of the agent-based simulation. Hence, the mechanisms are tested on the theoretical, *not empirical*, level in the following analysis.

5. Simulation Results

The overall aim of our analysis of the simulation output was the identification of logical configurations causing a constellation of polarized pluralism. To this end, we first utilized a linear regression to explore the general patterns the ABM reveals. Then we started identifying the relevant conditions for the center cabinet's effect by applying correlation analysis of cabinet type with outcome polarization under different parameter configurations. Using Boolean algebra, we demonstrated the circumstances under which center cabinets are decisive to explain centrifugal drives.

Table 2: Explaining the Final Level of Polarization

	Model 1	Model 2	Model 3a	Model 3b
Intercept	0.602** (0.002)	0.581** (0.002)	0.635** (0.002)	0.573** (0.002)
Polarization (t=0; start)	0.612** (0.001)	0.612** (0.001)	0.611** (0.001)	0.612** (0.001)
Cabinet type (0: Wing; 1: Center)	0.108** (0.001)	0.108** (0.001)	0.001 (0.001)	0.125** (0.001)
Limited Contestation (1: yes)		0.017** (0.001)	-0.082** (0.001)	0.017** (0.001)
Incumbent punishment (1: yes)		0.022** (0.001)	0.023** (0.001)	0.039** (0.001)
Cabinet type* Limited contestation			0.197** (0.002)	
Cabinet type* Incumbents' punishment				-0.033** (0.002)
adj. R-squared	0.219	0.220	0.224	0.220
N	2,500,000	2,500,000	2,500,000	2,500,000

Significance level: * 0.01 and ** 0.001; standard deviation in parentheses.

Starting with an overview, we analyzed the statistical relationship between the competition dynamic and cabinet type with the help of linear regression analysis. Furthermore, limited contestation and incumbent punishment were included

in the model to separately test two-level interaction effects. The dependent variable was the final polarization level within a simulation run and, in addition, the starting polarization was an independent variable. In this first step, we applied limited contestation without separating the two types. This distinction was made in the subsequent analysis steps.

The regression models revealed a rather weak effect of the cabinet type. However, this effect was significant and positive. Center cabinets are more likely to result in increasing polarization than wing cabinets. Thus, the searched dependency was, at least, present in the ABM. Nevertheless, the partial explained variance based on cabinet type was just 0.007 in model 1. The significance level was based solely on the high number of cases instead of the effect strength. Regarding all simulation runs, this effect is indeed insufficient to statistically explain the polarization level.

In model 2, limited contestation and incumbent punishment were included. Both variables showed the expected positive effect and squared R increased slightly. Furthermore, two interaction effects were added step by step. First, the interaction between cabinet type and limited contestation revealed a positive, significant coefficient. Concurrently, the effect of cabinet type became insignificant and the explained variance increased somewhat. Hence, the effect of the cabinet type depends on the presence of the mechanism of limited contestation. On the contrary, the second interaction effect was weaker and negative.

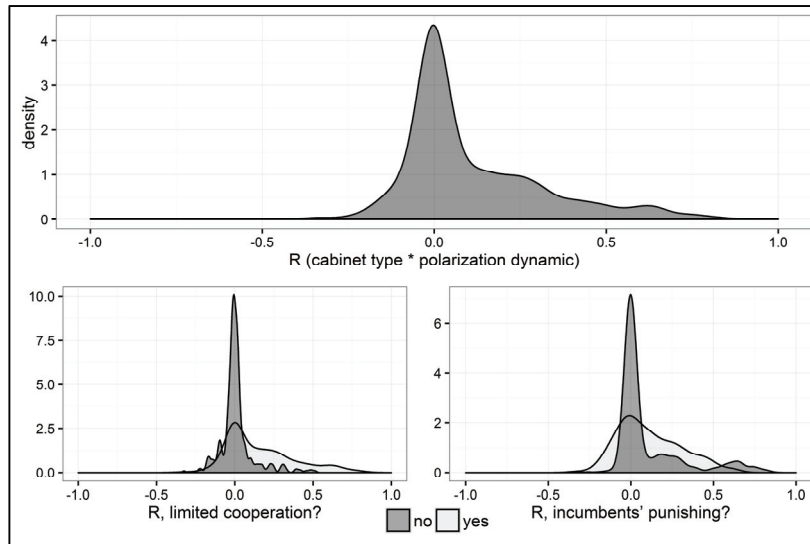
When limited contestation and incumbent punishment were both absent, the distributions were virtually identical in simulation runs with wing and center cabinets (see Appendix Figure 13). Hence, there was no dependency between government-opposition patterns and the polarization dynamic. Only when limited contestation was present could we observe a systematic difference in the polarization dynamic between runs with wing and center cabinets. This corroborated our main assumption derived from Sartori's party system theory. However, all effects were rather weak and the sole presence of limited contestation does not explain the substantial impact of the cabinet type on the polarization dynamic. Furthermore, the weak interaction effect between cabinet type and limited contestation depended on the centripetal dynamic by wing cabinets.

To examine potential conditions for dependency, we next analyzed the influence of cabinet type in varying parameter configurations. Therefore, we calculated the correlation within different subsamples. Each subsample contained a specific parameter constellation.⁴ In sum, there were 1152 subsamples. Here, the dependent variable of interest was the correlation between cabinet

⁴ Simulation runs were assigned to different subsamples based on the following parameters: categorized party number (low: 3-4, medium: 5-7, high: 8-10), limited contestation, incumbent punishment, voter preference distribution, non-policy factor distribution, the occurrence of policy- and office-seeking goals, as well as the categorized information capacity (low: \leq median, high: $>$ median).

type and polarization dynamic. The presence or absence of the input parameters were the dependent variables. The following calculations refer to this dataset (for an illustration of this dataset structure see Appendix Table 6). The distribution of the correlation coefficients revealed a noticeable variance.

Figure 6: Density Plots of Correlation Coefficients



In the upper plot, we observed that there was no (or a rather weak) correlation in most subsamples. Furthermore, no strong negative correlations were present. In contrast, we found some configurations with a strong positive relationship. In sum, 78 configurations showed a correlation coefficient above 0.5. In the bottom plots, the distribution is distinguished by the presence of limited contestation (left) and incumbent punishment (right). Unsurprisingly, if incumbent punishment and limited contestation were absent, configurations with significant correlations did not appear. In all configurations with correlations above 0.52, limited contestation was present. In contrast to incumbent punishment, this mechanism is clearly necessary for the dependency between cabinet type and the polarization dynamic. On the contrary, the incumbent punishment was also absent from all configurations with a very high correlation ($r \geq 0.66$). Next, we examined the effect of different model parameters on the correlation via linear regression analysis.

The regression disclosed that the mechanism of limited contestation influences the degree of correlation. Furthermore, office-seeking goals positively affected the examined relationship. This impact is not surprising, because the appearance of limited contestation presupposes an office-seeking objective. In

addition, party number and policy-seeking weight also exhibited positive and significant coefficients. Hence, all non-vote-seeking heuristics increased the statistical effect of a center cabinet on the competition dynamic.

Table 3: Explaining the Occurrence of a High Dependency of Cabinet Type with the Polarization Dynamic

DV: R cabinet type * polarization dynamic	Model 1	
	Coeff. B	S.E.
Intercept	-0.143**	0.016
Office-seeking weight > 0 (1: yes)	0.150**	0.009
Policy-seeking weight > 0 (1: yes)	0.107**	0.009
Voter distribution (1: bimodal)	-0.010	0.009
incumbent punishment (1: yes)	0.009	0.009
Reference: Low party number		
Medium party number	0.031*	0.011
High party number	0.059**	0.011
Reference: No limited contestation		
Limited contestation type I	0.091**	0.011
Limited contestation type II	0.204**	0.011
Reference: Non-policy distribution type I		
Non-policy distribution type II	0.025	0.013
Non-policy distribution type III	-0.019	0.013
Non-policy distribution type IV	-0.022	0.013
adj. R-squared		0.396
N		1152

Significance level: * 1% and ** 0.1%.

To go into more detail, we examined the parameter configuration, which exhibited a very high correlation. The defined threshold was an explained variance of at least 50 percent. In total, 15 constellations met this criterion.

Each row represents one set of a parameter configuration that leads to a high explained variance by the cabinet type. For example, regarding the first row of the table, there is an effect of the cabinet type, when the number of parties is between five and seven, limited contestation is present, parties aim for office-, policy-, and vote-seeking goals, the voter distribution is unimodal and so on. To summarize this rather large table, we minimize these results based on Boolean algebra. Therefore, Figure 7 outlines the result.⁵ Each shape represents a model parameter of the table and each link symbolizes a logical “and”-

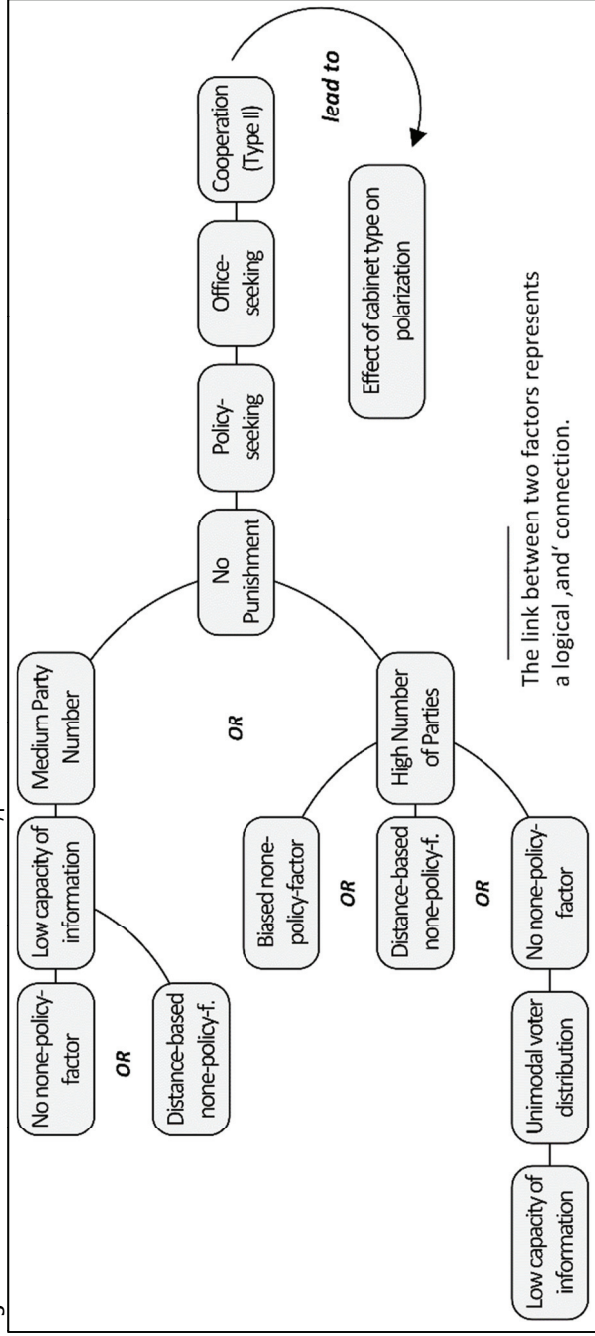
⁵ In more detail, the result is following equation: $O_{PeC_{II}} * (iN_{med}(D_I + D_{III}) + N_{high}(D_I(i + v) + D_{III} + D_{IV})) \rightarrow R^2_{\geq 0.5}$. The equation refers to Boolean algebra terminology. The *logical or* is represented by a “+” and the *logical and* by a “*.” Furthermore, uppercase symbolizes the presence of the parameter, whereas lowercase symbolizes its absence.

dependency between two parameters. One continuous way without any turning represents one set of parameter configurations, which sufficiently leads to an effect of the cabinet type within the simulation model. A fork separates two different sets and is marked by a logical “or.” Hence, we have five different sets which are sufficient for the presence of an effect of the cabinet type on the polarization dynamic:

Table 4: Parameter Configurations with a High Correlation of Cabinet Type with Polarization

Number of parties (class)	Limited contestation	Office-seeking	Policy-seeking	Voter distribution	Incumbent punishment	Non-policy distribution	Information (class)
N	C	O	P	V	E	D	I
Medium	Type II	Present	Present	Unimodal	No	Type I	Low
High	Type II	Present	Present	Unimodal	No	Type I	Low
High	Type II	Present	Present	Bi-modal	No	Type I	Low
High	Type II	Present	Present	Unimodal	No	Type III	Low
Medium	Type II	Present	Present	Bi-modal	No	Type I	Low
High	Type II	Present	Present	Bi-modal	No	Type IV	Low
High	Type II	Present	Present	Bi-modal	No	Type IV	High
High	Type II	Present	Present	Bi-modal	No	Type III	High
Medium	Type II	Present	Present	Unimodal	No	Type III	Low
High	Type II	Present	Present	Unimodal	No	Type III	High
High	Type II	Present	Present	Unimodal	No	Type IV	Low
High	Type II	Present	Present	Bi-modal	No	Type III	Low
High	Type II	Present	Present	Unimodal	No	Type I	High
Medium	Type II	Present	Present	Bi-modal	No	Type III	Low
High	Type II	Present	Present	Unimodal	No	Type IV	High

Figure 7: Conditions for an Effect of the Cabinet Type



First of all, office- (O) and policy-seeking (P) weights are necessary for the presence of a strong correlation. Thus, purely vote-seeking parties hinder the occurrence of a strong impact. Furthermore, the absence of incumbent punishment (e) is also inevitable. The punishment slightly reduces the difference between the average dynamics of runs with wing and center cabinets. Furthermore, limited contestation (C_{II}) is obviously also necessary. Here, only limited contestation that is avoiding any cabinet contestation is part of the explaining configuration. The OLS-regression showed that this type increases the dependency more than partial contestation (see Table 3).

Furthermore, a medium or high number of parties (N_{med} and N_{high}) is required. Sartori (1976, 131) already discussed this necessity. In party systems with fewer than five parties, a strong impact by the cabinet type on the competition dynamic does not appear. Thus, the model supports the outlined presumption. Lastly, only one type of non-policy factor distribution was not part of the configuration: the random draw (D_{II}). Thus, a missing non-policy factor or a somehow correlated non-policy factor is presupposed for cabinet type's effect. In some constellations, low information capacity is also needed. A low information capacity hinders a party's finding of global utility maxima. Parties' sticking in local maxima can explain centrifugal shifts under a non-polarized electorate.

To summarize, the regression model and the configurational analysis showed that there are several conditions and influence factors related to the occurrence of the dependency of cabinet type on ideological dynamics. In particular, an office-seeking motivation, limited contestation, and a high number of parties explain the appearance of this relationship. However, up to this point, we have only explained the effect of cabinet type on the polarization dynamic, but have not yet answered the original question: When do center cabinets have a centrifugal effect? The distribution of polarizing dynamics within the outlined parameter constellation of Figure 7 (see Appendix Figure 14) reveals that the median dynamic within runs of center cabinets is close to zero. Hence, almost half of the runs lead to a decreasing polarization even though a center cabinet is present. The strong correlation does not rest upon the centrifugal effect of center cabinets; on the contrary, the centripetal impact of wing cabinets causes the strong statistical relationship.

As the last step, we analyzed the conditions for the polarizing impact of center cabinets. For this purpose, beyond the correlation, we added a second criterion to select parameter configurations: the consistency of center cabinets as a sufficient condition for the occurrence of an increase in polarization. This measure was originally developed as part of the QCA (Ragin 2006). Here, this indicator reveals the number of simulation runs with center cabinets and an increasing polarization divided by the total number of center cabinet runs. Thus, we looked for parameter configurations that showed a strong correlation between cabinet type and the polarization dynamic, as well as the high consistency of center cabinets, as a sufficient condition for the presence of a cen-

trifugal push. Because none of the original configurations met these criteria, we added two more variables: starting polarization and the standard deviation (SD) of voter distribution.⁶

Based on the selected 10 parameters, the correlation and consistency were calculated in 4608 different parameter constellations. Here, we defined the following thresholds: a consistency of at least 0.95 and a correlation of at least 0.6. In such a configuration, most center cabinet runs led to a centrifugal push and there was a relatively high discrepancy between wing and center cabinet repetitions. In sum, six configurations met these criteria.

Table 5: Explaining the Centrifugal Push by Center Cabinets

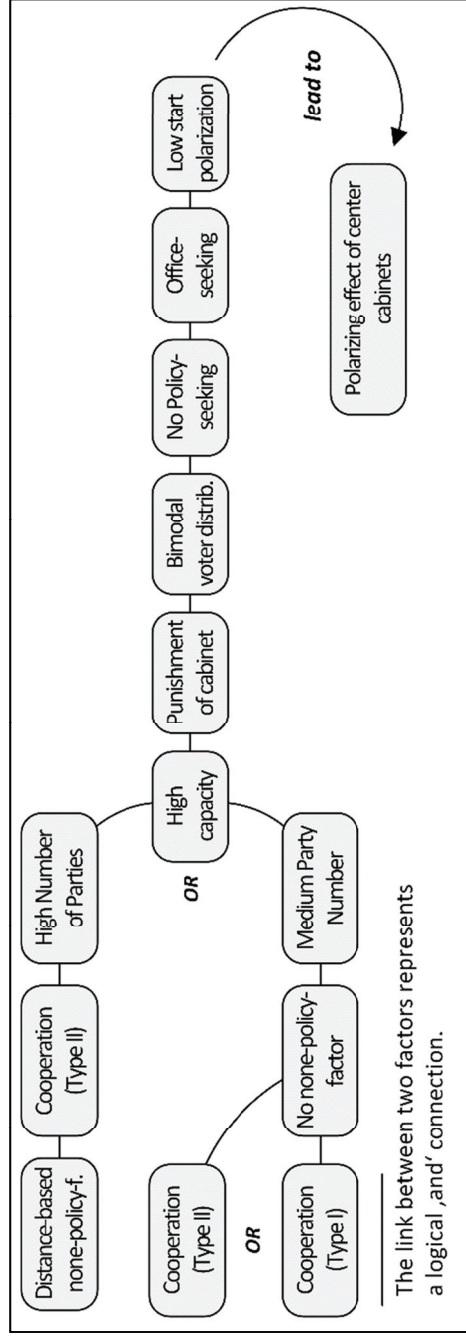
Polarization (start, class)	Number of parties (class)	Coalition cooperation	Office-seeking	Policy-seeking	Voter distribution	SD of voter distribution	Incumbent punishment	Non-Policy distribution	Information (class)
S	N	C	O	P	V	T	E	D	I
Low	Medium	Type II	Yes	No	Bimodal	Low	Yes	Type I	High
Low	Medium	Type I	Yes	No	Bimodal	Low	Yes	Type I	High
Low	Medium	Type I	Yes	No	Bimodal	High	Yes	Type I	High
Low	High	Type II	Yes	No	Bimodal	High	Yes	Type III	High
Low	High	Type II	Yes	No	Bimodal	Low	Yes	Type III	High
Low	Medium	Type II	Yes	No	Bimodal	High	Yes	Type I	High

Furthermore, we proceed in the same way as before. The minimization resulted in the following figure.⁷

⁶ To add these metric variables to the truth table, categorized variants were included. There were two categories of starting polarization and voter distribution's SD: low (\leq median) and high (high: $>$ median).

⁷ In addition, the equation of the result is: $sOpVEI * ((N_{med}D_I(C_I + C_{II})) + (N_{high}D_{III}C_{II})) \rightarrow Cons_{\geq 0.95} * R_{\geq 0.6}$.

Figure 8: Conditions for an Effect of the Cabinet Type on the Polarization



Interestingly, there are some substantial differences to Figure 7. First, the presence (not the absence) of incumbent punishment is necessary for high consistency. This change depends on its two different impacts within the model. On the one hand, this parameter led to a decreasing correlation, but on the other, its presence is necessary for a polarizing dynamic. Hence, it hinders the occurrence of a very strong correlation, but results in a centrifugal push. Furthermore, the non-appearance of policy-seeking goals is also necessary, because polarizing dynamics are often hindered by a party's non-responsiveness in the case of (partial) policy-seeking parties.

This time, both types of limited contestation were part of the explanatory configuration. In addition, a high voter polarization but low starting polarization creates the preconditions for a polarizing dynamic. In summary, *center cabinets in contrast to wing cabinets lead to a centrifugal dynamic on the conditions (1) of an unpolarized party system, but polarized electorate, (2) a medium or high number of parties as well as (3) incumbent punishment in combination with limited contestation*. The distribution of the competition dynamic within runs of these parameter configurations revealed exactly the theoretical effect of the government-opposition patterns that we initially discussed.

Finally, we tested the influence of some cabinet characteristics on the effect size. This analysis referred to a preliminary discussion outlined in the political science literature. Commonly, the effect is ascribed to surplus coalitions.⁸ However, does the electoral size of the cabinet also matter?

To test presumptions about the characteristics of the cabinet, three cabinet attributes were separately added to the explanatory configuration (see Figure 8): (1) The presence of a coalition of parties or a one-party cabinet, (2) whether the cabinet is oversized (this includes all cabinets with a summed vote share of at least 0.6), and (3) whether the cabinet loses votes within the run.

Table 6 shows that a coalition's electoral size and the number of cabinet parties are more or less irrelevant. The cabinet type influences the dynamic independent of these characteristics. In particular, the missing effect of the existing coalition might seem to be paradoxical because limited intra-cabinet contestation presupposes more than one party. However, the main reason behind the interaction effect of limited contestation and cabinet type is not cooperation within the cabinet. The cause of the effect is the impact on the opposition. Limited contestation hinders oppositional opportunities within office-seeking strategies. This constraint is especially enhanced when a center cabinet is present. In turn, the opposition's lack of office-seeking utility leads to extreme positioning and then to increasing polarization.

⁸ We use the term of "surplus coalition" to describe a coalition with a huge majority.

Table 6: The Impact of a Cabinet's Characteristics

Figure 8 * is a coalition?	... * is an oversized cabinet?	... * is a cabinet that lost votes?
Correlation ¹	0.614 (+0.037)	0.581 (+0.004)	0.764 (+0.187)
Consistency ¹	0.994 (0.000)	0.994 (0.000)	1.000 (+0.006)
Coverage ¹	0.661 (+0.056)	0.613 (+0.008)	0.908 (+0.303)

¹Correlation means the correlation between cabinet type and polarization dynamic within the parameter configuration. In addition, the consistency and coverage describe the consistency (or coverage) of the cabinet type as a sufficient condition for an increase in polarization. Furthermore, the number in parentheses is the difference compared to the original configuration (Figure 8).

On the contrary, adding a cabinet's loss of support to the configuration enhances the consistency and correlation. Here, the consistency amounts to one. Hence, all runs with a center cabinet produce centrifugal dynamics. This insight shows the reason behind the deviant cases in Figure 8. All repetitions with center cabinets and a centripetal dynamic are simulation runs with a center cabinet that was electorally successful in spite of penalization by voters.

In sum, the ABM shows that government-opposition patterns shape polarization in the theoretically expected way. In particular, the mechanism of limited contestation explains this macro-level dependency. However, the complete explanation of a centrifugal push by center cabinets is more complex. The outlined results suggest that the cabinet in combination with limited contestation, non-moderate vote-seeking incentives (e.g., a polarized electorate), and voters' punishment is a causal chain that explains increasing polarization.

6. The Example of a Hypothetical German Election

Furthermore, we illustrate the outlined mechanism by one example. Here, we show and describe a specific simulation sequence. For the example, we choose a six party system based on a hypothetical federal election in Germany.⁹ However, this example is neither a forecast nor a test of the mechanism. We simply want to point out the causal chain of our previous analysis. The party positions are based on the CHES expert survey of 2014 (Bakker et al. 2015)¹⁰ and we

⁹ The article was finalized before the parliamentary elections in September 2017.

¹⁰ The scale is adjusted via the multiplication by the factor of ten.

calibrate the voter distribution as well as the distribution of the non-policy factor referring to recent polls. Our example contains the following scenario¹¹:

Table 7: Parties of the Example*

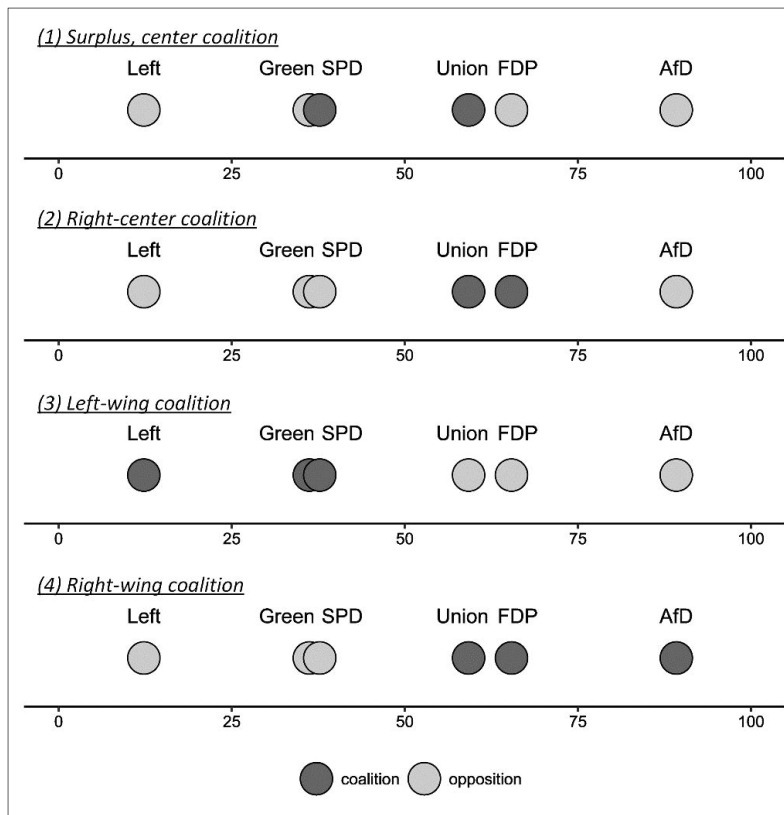
Party	Abbreviation	Vote Share	Position
Christian Democratic Union of Germany and Christian Social Union	CDU/CSU, or: Union	41.1%	59.2
Social Democratic Party of Germany	SPD	25.7%	37.7
The Left	Left	8.6%	12.3
Alliance 90/The Greens	Green	10.4%	36.2
Free Democratic Party	FDP	6.4%	65.4
Alternative for Germany	AfD	7.8%	89.2

*The position of the Union is the mean position of the Christian Democratic Union and the Christian Social Union.

Furthermore, we vary the formed coalition after the election in four ways: (1) the continuation of the current surplus, center coalition of SPD and Union, (2) a right, center coalition of Union and FDP, (3) a left-wing coalition of the Left, Greens, and SPD and (4) a right-wing coalition of the AfD, FDP, and Union. Of course, both wing coalitions are not likely, because neither the Left nor the AfD are considered as potential coalition partners by the other actors. Nevertheless, both parties would be necessary to form the ideal type of a wing coalition. The point of interest is not the realism of this specific scenario. We want to illustrate the mechanism by this admittedly rather hypothetical example. The starting positions of all parties and the remaining parameter configuration are identical between all runs with the exception of the coalition:

¹¹ The NetLogo-File of the example can be downloaded from our project homepage <www.pruf.de/dfg-projekt-opposition>, Accessed January 17, 2018). The exact parameter configuration is the following: Iterations = 50, random seed = 706242532, information capacity = 1, number of parties = 6, vote-seeking weight = 0.333, office-seeking weight = 0.333, policy-seeking weight = 0.333, limited contestation of type II, a unimodal voter distribution with a standard deviation of 19 and 10000 voters, a biased distribution of the non-policy factor (type IV) with a non-policy weight of 5 and, finally, a present punishment of incumbents with an weight of 5 (for an overview of all model parameters, see Table 1).

Figure 9: The Starting Point of the Exemplary Runs*



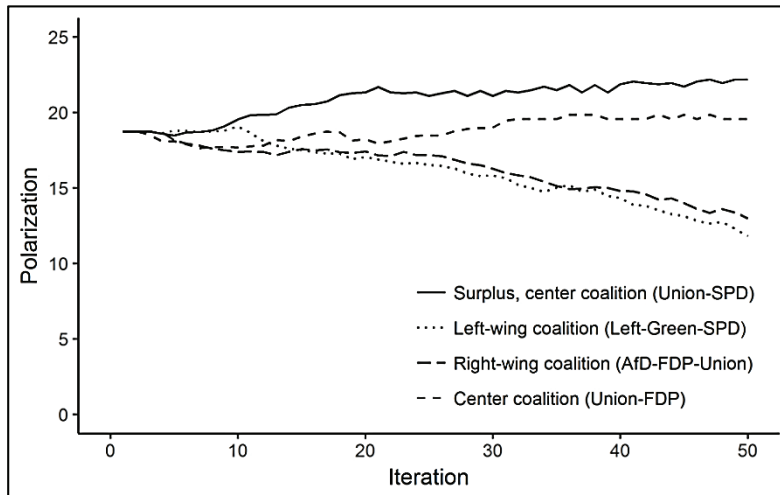
* Each circle in combination with its character represents one party. The filling reveals party's status. Cabinet parties are filled dark gray in contrast to opposition parties.

The calibration of the properties of the electorate creates an advantage for the SPD and Union regarding the distribution of the non-policy factor within the moderate electorate. Thus, more voters of the center identify with these both parties giving them an edge to win. This advantage is somewhat stronger for the Union. The FDP and Green party exhibit an identification bonus by few voters around the left and right wing, which represents their core voters. On the contrary, the Left and AfD especially win votes because of their distance to the other parties. This scenario is created by the calibration and not by empirical data. Furthermore, all parties pursue policy-, office-, and vote-seeking goals to the same extent. The coalition cooperates and avoids any contestation (type II). Lastly, the coalition is evaluated negatively by the voters and, as consequence,

punished by the electorate due to a small handicap. These conditions are identical between all three runs.

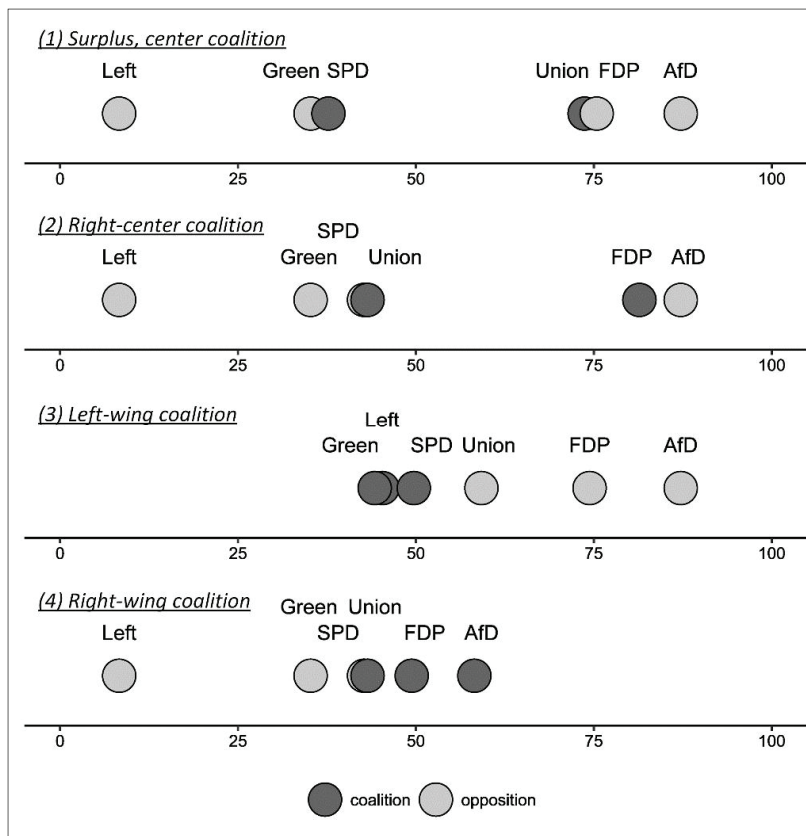
The key result of the exemplary runs are the varying patterns of polarization. While both wing coalitions lead to a centrifugal trend and a lowering polarization, both center coalitions have the opposite impact, but the surplus type has a more centrifugal impact.

Figure 10: The Polarization Dynamics



The differing levels of polarization are caused by the government-opposition patterns. Within the run of the surplus, center coalition, the Social Democrats orient themselves towards the center and contest the Green party. The Left stays at its position. A similar pattern can be observed on the right wing. The ideological center is not contested in this simulation run. The other center coalition formed by the Union and the FDP also initiates an increasing polarization. However, this push is weaker for two reasons: First, the SPD contests the Union at the center and therefore has no increasing effect on the polarization level. Second, because the FDP has a lower vote share than the Union, their movement towards the right wing is less relevant for the polarization. On the contrary, wing coalitions reduce ideological differences within its group and contest the ideological center. In response to that, the opposition parties also move towards the center. Inversely, these patterns can be observed under both types of wing cabinets. The positioning of the parties on the left-right dimension in the last iteration is outlined by the following figure:

Figure 11: The Output of the Fiftieth Iteration*



* Each circle in combination with its character represents one party. The filling reveals a party's status. Cabinet parties are filled dark gray in contrast to opposition parties.

Our parameter configuration of the simulation model allows a prototypical demonstration of the effect. However, different variations of the parameters can lead to a lowered effect of the cabinet type. Here, we want to discuss some of the crucial modeling decisions. Allowing partial contestation within the coalition weakens the mechanism. Referring to our example, we can easily argue that the SPD and Union only cooperate to certain extent. This consideration would lower the polarizing effect of the surplus, center coalition, because both parties would not abandon the center. Additionally, the wing coalition induces a less centripetal effect under a partial contestation. Here, the Left and AfD would position themselves further away from the center. Also, a higher policy-seeking priority of the AfD and Left would alternatively prevent a movement towards the center.

On the contrary, two factors can enhance the effect of the coalition type. First, three parties in a center coalition lead to a more polarizing trend, e.g. a coalition of Union, SPD, and FDP. If the FDP – as part of the coalition – positions itself more to the center, the Union will win the right wing of the electorate by a non-moderate positioning because of its identification advantage against the AfD. Regarding the scenario of a Union-SPD coalition, the FDP and its core voters prevent such a move. Furthermore, the normal distribution of the voters provides only very few vote-seeking incentives for a non-moderate positioning. In contrast, a bimodal voter distribution would change this incentive structure and enhance the polarizing trend of the center coalition.

Thus, these hypothetical examples outline the impact of the mechanism. Finally, we discuss the implication of our results in the next section.

7. Discussion

Currently, the literature on party system polarization and on party positioning talk past each other. We demonstrate in this article how an ABM is suitable to combine both literature branches in order to generate a complete macro-micro-macro-explanation of party system polarization. Referring to the classical work of Sartori (1976), who points out the importance of the cabinet type on party system dynamics, we identify two basic mechanisms: limited contestation between and incumbent's punishment.

Referring to the outlined model, the impact of cabinet type on the party system's polarization rests upon the structuring of parties' interaction patterns. In particular, limited contestation can explain the centrifugal push by center cabinets. Due to the cooperation of cabinet partners, the opposition has no real chance to enter the government. This results in a reduction of oppositional office-seeking opportunities for opposition parties and hence rather extreme positioning.

In addition, a polarized electorate that is disappointed by the government's policy ensures the electoral success of this oppositional strategy. As a consequence, the polarization increases and a competition of polarized pluralism arises. In the same competitive situation, a wing cabinet could prevent such a centrifugal push, because of three facts: (1) the disappointed voter has a moderate alternative, (2) the crucial votes to replace the current government are located in the ideological center for the opposition regardless of the electorate's preference distribution, and (3) the opposition's accession to governmental power is possible. In consequence, this opportunity crucially shapes the strategic calculus of the opposition.

The ABM allows us to deeply analyze the complex and dynamic patterns of the party competition model. Furthermore, the test of the explanatory mechanism provides a possible micro-foundation for a common and established theo-

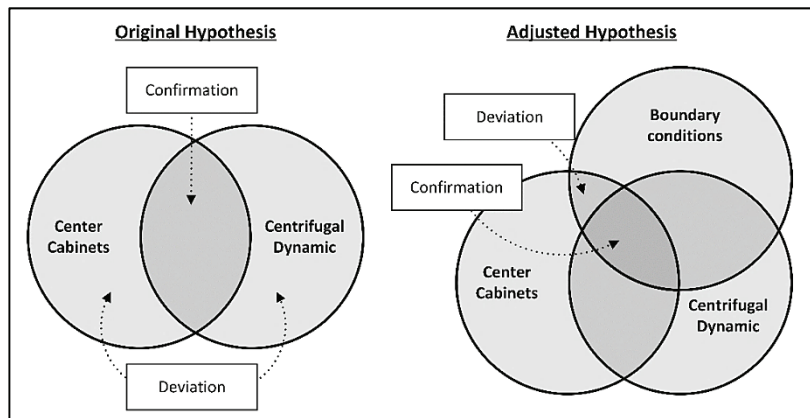
retical framework in the party system literature. However, the question is whether this improvement of our knowledge of the effect of government-opposition patterns is relevant – or is the presented micro-foundation itself the final goal?

Of course, one might argue that the assurance of the theory's logical consistency, the clarification of the causal chain, and the unveiling of (thus far) implicit axioms are benefits on their own. However, we additionally argue that the most important feature of the agent-based micro-foundation is the precision of our theoretical expectation based on the framework. The presented results have some crucial practical implications. The original hypothesis based on Sartori's (1976) typology is that a bilateral opposition and occupied ideological center lead to polarized competition. This argument implies an expectation of a more-or-less (deterministic) linear effect. A center cabinet is sufficient for the occurrence of polarization and a wing cabinet is sufficient for the presence of a centripetal shift. Based on the simulation results, we decisively modified this hypothesis. The final explanatory configuration (Figure 12) makes the causal structure clear: Center cabinets are an insufficient but necessary part of a condition, which is itself unnecessary but sufficient (or an INUS condition; Mackie 1965) for the occurrence of a polarizing dynamic. Within the outlined configuration – presence of limited contestation, a medium or high number of parties, a polarized electorate, and so on – a center cabinet is necessary so that this configuration leads to a centrifugal push. Furthermore, a center cabinet lacking these boundary conditions does not influence the competition dynamic in any way. Therefore, the evaluation of the empirical covariance depends on the chosen hypothesis. We depict the potential difference with the help of Venn diagrams in Figure 12.

Based on the original hypothesis, the overlap of the sets of center cabinets and polarizing dynamics represents the theory's confirmatory cases. The theory would be perfectly confirmed if both sets were identical. Here, the explained variance between both variables would be one. In contrast, the number of times both sets do not overlap represents the deviating cases (for example, center cabinets that lead to a centripetal dynamic or polarizing wing cabinets). In this hypothetical example, we would clearly reject the original hypothesis and would actually find a negative correlation. Therefore, we would reject the theory's accuracy and assume a centrifugal effect by wing cabinets.

On the contrary, the empirically interesting sets change based on the adjusted hypothesis (right part of Figure 12). Here, we assume that the center cabinets are in an INUS condition. Therefore, the confirmation is the overlap of the entire sufficient condition (Figure 8 combined with center cabinets) and the set of centrifugal dynamics. In contrast, the deviating cases are the overlap of the center cabinets and boundary conditions only. Here, the proportion of confirmatory cases would be higher and we would confirm the empirical hypotheses.

Figure 12: Confirmation and Rejection of the Original and Adjusted Hypotheses



This hypothetical example illustrates the impressive change in the evaluation of empirical patterns of covariance due to the micro-foundation. Thus, developing the micro-foundation of a macro-level theory is a crucial step within the research design. The ABM method is thereby a powerful tool to analyze theoretically complex and dynamic social systems with a potentially strong influence on the subsequent empirical research.

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Appendix

Table 8: The Correlation within Different Parameter Configurations (Exemplary Extract of the Dataset)

Number of parties	Limited contestation	Office-seeking weight	Policy-seeking weight	Voter distribution	Incumbents' punishing	Non-policy distribution	Information level	Correlation	Number of runs
Low	No	No	No	Bimodal	Yes	Type IV	Low	-0.12	2266
Medium	No	No	No	Unimodal	No	Type III	Low	-0.02	3398
Medium	Type I	No	No	Unimodal	No	Type IV	Low	0.00	1953
Medium	No	Yes	Yes	Bimodal	No	Type III	High	0.02	3854
Medium	Type II	No	Yes	Bimodal	Yes	Type I	Low	0.24	2025
Low	Type II	Yes	Yes	Bimodal	No	Type III	Low	0.67	2332
Medium	Type I	No	No	Bimodal	No	Type II	Low	-0.01	1945
High	Type I	No	Yes	Unimodal	No	Type I	Low	-0.01	1975
Medium	No	No	No	Unimodal	Yes	Type II	High	0.05	2260
High	No	No	No	Unimodal	Yes	Type IV	High	-0.10	2307
Medium	Type II	Yes	Yes	Unimodal	No	Type II	High	0.57	2313
Low	No	Yes	No	Unimodal	Yes	Type III	Low	-0.09	2278
[1152 cases included in the entire dataset]									

Figure 13: The Missing Centrifugal Push by Center Cabinets

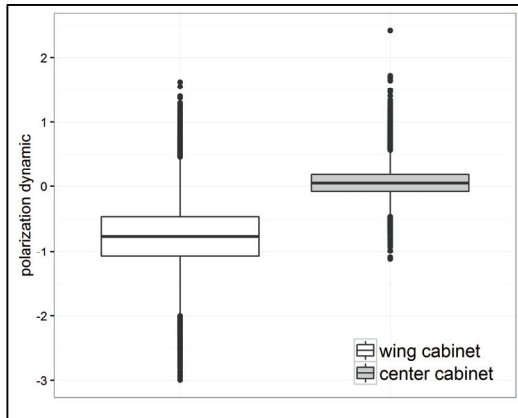
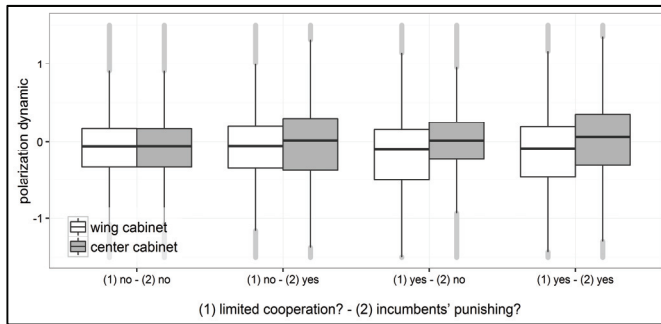


Figure 14: Boxplot of the Polarization Dynamics in Different Contexts



*Outliers (grey area) greater than 1.5 or lower than -1.5 are excluded in the plot. In consequence, 145,665 of 2.5 million cases are represented in the plot.