Party Politics: A Contest Perspective

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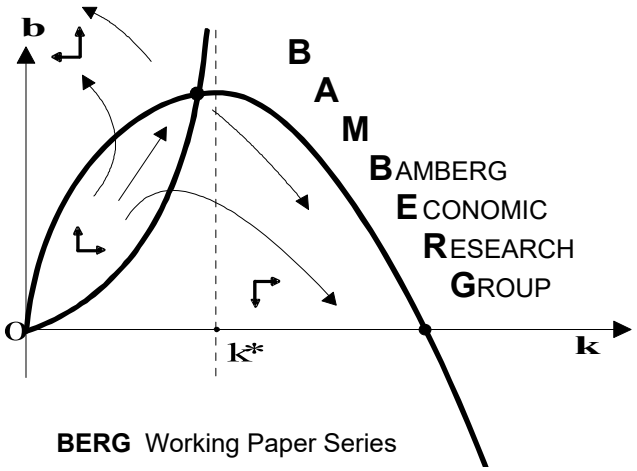

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Abstract

Intra-party contests, such as the US primaries, are often used to select a candidate for a subsequent cross-party election. A more accurate selection may improve the quality of the candidate but detract more resources from the subsequent campaign. We model this trade-off as a problem of contest design and show that extreme accuracy levels are optimal: maximum accuracy if the potential candidates are sufficiently heterogeneous, and a highly random selection otherwise. In an extension of our model, the heterogeneity between potential candidates reflects the degree of political polarization within a party. Our results explain varying primary designs within and between countries and shed light upon the paradox of limited competition within democratic parties.

Keywords: Contest Design; Accuracy; Elections, Intra-Party Competition; Political Polarization

JEL Codes: C72, D72.

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1 Introduction

Most democratic systems are based upon free political competition organized by political parties. Competition takes place on different layers: between and within parties. While competition between parties and their candidates is usually subject to strict constitutional or legal rules (electoral law), the formal requirements for intra-party competition are less severe. For example, the German constitution only requires that political parties "adhere to democratic principles". The parties thus have much discretion in organizing their internal (selection) processes.

Indeed, the design of intra-party competition varies not only between different countries but also between different parties within a country and over time. In the U.S., for example, both the Democrats and the Republicans select their presidential candidate during a long and intense process of well-established primaries and caucuses. In Germany, by contrast, the conservatives (CDU/CSU) traditionally used a much shorter and less transparent procedure to select their candidate for chancellor than the social democrats (SPD): while officially confirmed during a party convention, the actual decision often resulted from prior consultation behind closed doors (e.g., Wolfratshauser Frühstück). Only recently they have switched to a longer and more sophisticated procedure for selecting their leaders. Notably, this switch has been drastic: from almost no (observable) to very intense intra-party competition.

The parties' striving for power suggests that they design the internal selection process so as to maximize the winning probability of their candidate during the subsequent general election. This probability of success depends, among other things, on two important factors: the quality (ability, suitability) of the selected candidate and the available resources the party can invest into the electoral campaign. Intra-party competition may thus be subject to the following trade-off: a more accurate internal selection process may improve the expected quality of the candidate but, at the same time, consume more resources, which will then be lacking during the subsequent general election.

In this paper, we provide a model of contest design that captures this trade-off and explains the observed variation and polarization in intra-party competition. We thereby identify the heterogeneity (e.g., the political polarization) within a party as a potential determinant for the extent of intra-party competition. To this end, we model intra-party competition (the primary election) as a contest *within* parties and link it to inter-party competition (the general election), modeled as a subsequent contest *between* parties. We consider the political process as a three-stage game: First, parties design the primaries by choosing the accuracy of the internal selection contest. Then, the primaries take place and the applicants within each party compete against each other to become the party's candidate for the general election. Finally, the general election takes place and the parties' candidates compete against each other to become president.

Our model reflects a party's conflicting objectives: a more accurate selection may improve the quality of the candidate but detract more resources from the subsequent general election campaign because of increased contest intensity during the primary. We find that a party implements a highly accurate primary if and only if its members are sufficiently heterogeneous. Otherwise a highly random choice of the candidate is optimal, because this saves resources for the subsequent general election. Comparative statics illustrate that, in many cases, the accuracy choice is extreme: either maximum accurate or purely random.

A slight variation of the model enables us to include career concerns and reinterpret heterogeneity as the extent of polarization within a party. In this sense, our results suggest that political polarization may reinforce intra-party competition. Further extensions of our baseline model also discuss the effects of the number of parties, the number of candidates within a party, and information asymmetries.

Our paper contributes to the economic literature on competition between political parties. While most of the related articles treat political parties as single decision units, only few studies investigate the internal structures of a party and relate the processes of decision-making within a party to the process of decision-making in external competition with other parties. Helping to fill this gap, we focus on the design of intra-party competition. At first glance, it may seem paradoxical that *democratic* parties "limit" the extent of democratic competition when selecting their candidates. This paradox resolves, however, once strategic benefits are taken into account. In this spirit, our study provides a rationale for seemingly "autocratic structures" within democratic parties.

The remainder of this article is structured as follows: Section 2 reviews the related literature. Section 3 presents the model and Section 4 establishes the main result of polarized intra-party competition. In Section 5, we illustrate the comparative statics of our model by means of a situation in which the candidate of one party is incumbent. Section 6 introduces a variant of the model that enables us to include career concerns and discuss political polarization. Section 7 considers further extensions of the model. Section 8 concludes.

2 Related Literature

Our work relates to three different strands of the literature. First, we contribute to the literature on contest design and theory. Our model design starts from a simple Tullock contest (see Tullock 1980). We focus on the accuracy parameter of the contest success function, also referred to as decisiveness or discriminatory power, which is extensively discussed among others in Nti (2004), Alcalde & Dahm (2010), Wang (2010), Yildirim (2015), Ewerhart (2017*b*), and Drugov & Ryvkin (2020).[1] In contrast to the existing

[1] An extensive literature overview is given by Mealem & Nitzan (2016).

literature, we explore the decision of the contest designer when she faces a trade-off between accuracy and intensity of the contest. Thus, we analyze an optimal accuracy choice problem, where the contest itself serves as a selection mechanism (Sahm 2022). To the best of our knowledge, the theoretical literature has not yet considered a strategic decision about the accuracy of a contest.

On the empirical side, Winfree (2021) relates to our research as he analyzes the accuracy choices of a sports league designer when selection quality may be harmful or beneficial to the contest designer. Similar to us, Winfree (2021) focuses on heterogeneity of contestants,which partly determines the optimal contest accuracy. Below, we likewise argue that the contest designer can control the accuracy by, e.g., determining the duration of the contest. Lacomba et al. (2017) experimentally analyze the effect of accuracy on heterogeneous endowed contestants in a conflict. They find that higher contest accuracy leads to a more peaceful outcome. Similarly to our research, Lacomba et al. (2017) emphasize how accuracy concerns affect the trade-off of between resources and intensity of the contest. They argue that accuracy is an important tool to circumvent costly conflict.

Second, we add to the rapidly growing literature on group contests (see, e.g., Choi et al. 2016). Previous studies in this strand of research mostly considered the political arena as one example among many, without taking into account the peculiarities of political contests. The central trade-off in our model occurs because the intra-group contest affects the outcome of the inter-group contest. A key aspect of our model is the heterogeneity of group members. Dependent on the accuracy of the intra-group contest, a more or less qualified applicant will be promoted as candidate for the inter-group contest. The heterogeneity within the group, however, also determines the intensity of the intra-group contest (see, e.g., Berger & Nieken 2016). To the best of our knowledge, we are the first ones to analyze the accuracy parameter in a group contest setting.

Third, we contribute to the literature on political processes, in particular the internal perspective of political parties. The economic literature is scarce in this regard. Only few exceptions are related to our research insofar as they also account for the link between intra-group and inter-group contests: Bhattacharya & Rampal (2019) analyze a group contest with varying group size and strength, but refrain from motivating the design of the intra-group contest. Crutzen et al. (2020) analyze the effects of varying prize structures in intra-group contests and relate their findings to open and closed list representation within parties. The model of Crutzen et al. (2020) captures two different designs of intra-party competition, but does not include any heterogeneity of contestants which is one of the central reasons for designing a contest. Sheremeta (2010) conducts an experiment where he tests a theoretical model of party competition. In particular, he studies the effect of carry-over from primaries to general election as well as the number of candidates. In our model, we assume that a party has a limited budget for both the primary and the general election. In a sense, a party board aims to carry over as many resources as possible from

the primary to the general election. Lastly, Mattozzi & Merlo (2015) analyze reasons for politicians' mediocracy. They argue that parties may select a group of mediocre party leaders in order to extract the most aggregated group effort in the general election. In contrast to our research, they mainly focus on the competitive design of the general election. While the aforementioned articles study the link between intra-group and inter-group contests in situations where the design of the primary, i.e., the intra-group contest, is either fixed or the result of a discrete choice, our research focuses on the endogenous and continuous decision about the accuracy of the primary.

Within the political science research, Serra (2011) proposes a theoretical framework and argues that parties implement primaries to disclose the candidates' abilities. In addition, Serra (2011) relates the internal structure of parties to the ideology of members. If parties implement a primary, candidates may be more prone to ideological extremism of other party members. Other aspects regarding internal party structures are party unity and members' participation (see for example Scarrow 2021, Tromborg 2021, Kernell 2015). One argument of Kemahlioglu et al. (2009) is that parties hold primaries to coordinate themselves. Kemahlioglu et al. (2009) also present empirical evidence of Latin American democracies suggesting that the party size, the party's ideology, and the incumbency status affect the choice of holding a primary. Schindler (2021) highlights empirical evidence that party boards differ in comparison to broad membership selection of a leader. In particular, Schindler (2021) proposes that party boards select the leader in a more "professional" way, taking into account a wider range of aspects, such as party unity, and deciding in a more coordinated way. In our study we build on the empirical findings of the political science research. We interpret our model in terms of party unity and highlight the incentives of a party board varying the primary design.

3 Model

We consider the political competition between two parties $P \in \{A, B\}$ as a sequential game with three stages. At the first stage, the board of each party designs a primary election. In these intra-party contests, which take place at the second stage, two applicants with heterogeneous qualifications compete against each other to become the party's candidate for the subsequent general election. At the third stage, the general election takes place as an inter-party contest between the two selected candidates.[2]

Before we specify the three stages of the game more formally and in reverse order, let us briefly describe the basic trade-off that the model entails. A candidate's success in the general election depends on both, her qualification (ability, motivation, suitability) and her available resources. Each party board maximizes the winning probability of its candidate

[2]For simplicity, we restrict the analysis of the baseline model to two parties and two applicants each. We discuss extensions to more parties or applicants in Section 7.

in the general election by designing its primary election. A design that improves the selection quality may, however, also intensify intra-party competition during the primary, leaving fewer resources for the inter-party competition during the general election.

3.1 Third Stage: The General Election

At the third stage, the general election takes place. It is modeled as an inter-party lottery contest between the two selected candidates. The candidate of party $P \in \{A, B\}$ with qualification $v^P = 1/c^P$ chooses the investment y^P in order to maximize the probability of winning the election

$$\pi^P = \frac{y^P}{y^P + y^Q}, \tag{1}$$

subject to the constraint that the investment costs $c^P y^P$ must not exceed the party's remaining budget B^P. We assume that the remaining budget equals the party's initial resources R^P less the applicants' aggregate investments I^P during the intra-party contest, i.e., during the primary election at the second stage: $B^P = R^P - I^P$.

The assumption that the candidates maximize their success probability represents a simplification. In our model, in which the candidates do not invest into the general election at their own expense but can use the available resources of their party, it is, however, equivalent to the assumptions that the candidates receive an additional benefit from winning the election and maximize their expected payoff or utility.

3.2 Second Stage: The Primary Election

At the second stage, a primary election takes place in each party. It is modeled as an intra-party Tullock contest between two members of that party. The two competing applicants $i \in \{1, 2\}$ in party $P \in \{A, B\}$ may differ in their qualification (ability, motivation) $v_i^P = 1/c_i^P$, expressed by the inverse of their constant marginal investment cost $c_i^P \in [1, \infty)$. The winning probability of applicant $i \in \{1, 2\}$ in party $P \in \{A, B\}$ is given by the contest success function (CSF)

$$p_i^P = \begin{cases} \frac{(x_i^P)^{r^P}}{\sum_{j=1}^2 (x_j^P)^{r^P}}, & \text{if } X^P := \sum_{j=1}^2 x_j^P > 0, \\ 1/2, & \text{if } X^P = \sum_{j=1}^2 x_j^P = 0, \end{cases} \tag{2}$$

where x_i^P denotes the effort of applicant i, X^P denotes aggregate effort and r^P denotes the accuracy level of the contest in party P.[3]

[3]Sometimes, the accuracy level is also referred to as the discriminatory power or decisiveness parameter.

We may interpret the applicants' efforts in a physical sense as money or time they invest during the primaries. These resources are then no longer available for investments into the general election.[4] In a metaphorical sense, the applicants' aggregate effort can be understood as a measure of intra-party dissent which the electorate dislikes and which therefore reduces the party's probability of winning the the general election.

We assume that each applicant $i \in \{1, 2\}$ chooses her effort x_i^P in order to maximize her expected payoff from candidateship in party P

$$Eu_i^P = p_i^P - c_i^P x_i^P \quad \text{or, equivalently,} \quad EU_i^P = p_i^P v_i^P - x_i^P. \tag{3}$$

This assumption implies a kind of myopic behavior by the applicants as they only value their own success in the primary election but not their party's success probability in the subsequent general election. Neglecting such career concerns simplifies the analysis at this point and makes our baseline model tractable. Assuming a more sophisticated, far-sighted objective introduces an additional link between the primary and general election but, as we argue below (see Section 6), does not fundamentally change the basic trade-off.

3.3 First Stage: The Design of the Primaries

While in most democracies, such as Germany or the United States, the design of the general election is usually determined by the constitution, parties are free to choose how to select their candidates. We assume that (the board of) each party designs the primary election in order to maximize the probability of winning the general election. Notice that party applicants' investment during the primaries impact both determinants of success in the general election: the party's' remaining budget and the expected qualification of the party's designated candidate. The two objectives for designing the primary – selecting the better qualified applicant as the party's candidate and saving as many resources as possible – may, however, be conflicting.

We capture the potential trade-off between selection quality and resource management by considering the technology of the intra-party contest. In particular, we analyze the accuracy level r^P as the relevant parameter for party P's design of the primary election. Low values of r^P imply a noisy, probabilistic CSF and thus result in a highly random selection. Higher values of r^P reduce the noise and improve the selection quality but may come at the cost of higher investment. With regard to the political arena, we interpret the accuracy level as a measure of the length (time duration) of the primary election campaign or the number of events: the longer a primary lasts and the more events it

[4]Even though (the investments during) the primaries may have positive external effects on a party's success in the subsequent general election by generating publicity/momentum for its candidate and increasing voter turnout, it would be (at least weakly) more efficient to spend these resources directly on the general election campaign (by emphasizing the differences between rather than within parties).

involves, the more decisive it becomes but, at the same time, the more resources it may absorb.[5]

3.4 Information Structure and Timeline

How important the selection quality of a primary election actually is, depends crucially on the extent to which applicants differ in their qualifications. We assume the following information structure: At the beginning of an election period, each applicant $i \in \{1, 2\}$ in party $P \in \{A, B\}$ independently draws her qualification v_i^p. Within each party, the party board and the applicants observe the qualifications of both applicants, but the primary election is the only way to verify these qualifications towards the supporters and legitimate the selected candidate.[6] We normalize $v_1^p = 1$ and denote $v_2^p = w^P \in (0, 1)$. Thus, without loss of generality, applicant 1 has an equal or higher qualification (lower cost) compared to applicant 2.

Figure 1 summarizes the events of our model and illustrates the order in which they take place.

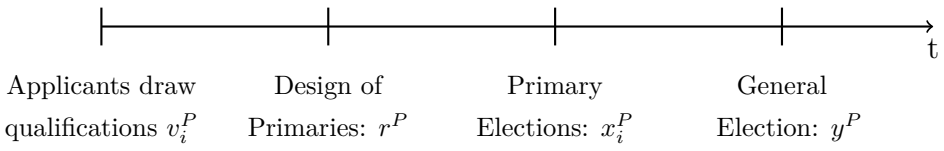

Figure 1: Timeline.

4 Analysis

In this section, we analyse the sequential game by backward induction and characterize the basic properties of the subgame perfect equilibrium (SPE).

4.1 Third Stage: General Election

Once the winners of the primary elections are nominated as the parties' candidates, they compete against each other in the general election with their qualifications v^P and remaining budget $B^P = R^P - I^P$. Candidates choose y^P in order to maximize the success probability π^P as given by equation (1) subject to $y^P c^P \leq B^P$ or, equivalently, $y^P \leq v^P B^P$.

[5]One may argue, for example, that parties in the US design a highly accurate primary, in which the quality of each applicant is thoroughly scrutinized: US primaries are usually held over a longer period of time, e.g., the democratic primary in 2020 started on the 3rd of February and ended on the 11th of August. During this time period there were several events such as public broadcasts where applicants competed for voters. Thus, the public accessibility and transparency contributed to our notion of a highly accurate primary design.

[6]We further discuss and relax these assumptions in Section 7.

Because there is no other use for a party's resources, the budget constraint is binding in equilibrium and the success probability of party $P \in \{A, B\}$ equals

$$\pi^P = \frac{v^P(R^P - I^P)}{v^P(R^P - I^P) + v^Q(R^Q - I^Q)}. \tag{4}$$

4.2 Second Stage: Primary Election

During the primary election of party $P \in \{A, B\}$, each applicant $i \in \{1, 2\}$ chooses the effort x_i that maximizes her expected payoff from candidateship as given by Equation (3).[7] Depending on the level of accuracy r, three different Nash equilibria may arise (see, e.g. Ewerhart 2017*b*, Table 1).

First, if $0 \leq r \leq 1 + w^r$ the equilibrium is unique and in pure strategies. It entails the effort levels

$$x_1 = \frac{rw^r}{(1+w^r)^2} \quad \text{and} \quad x_2 = \frac{rw^{r+1}}{(1+w^r)^2},$$

winning probabilities

$$p_1 = \frac{1}{1+w^r} \quad \text{and} \quad p_2 = \frac{w^r}{1+w^r},$$

aggregate effort

$$X = x_1 + x_2 = \frac{rw^r(1+w)}{(1+w^r)^2}, \tag{5}$$

and aggregate investment

$$I = c_1x_1 + c_2x_2 = \frac{x_1}{v_1} + \frac{x_2}{v_2} = \frac{2rw^r}{(1+w^r)^2} = \frac{2}{1+w}X. \tag{6}$$

Second, if $w^r + 1 < r \leq 2$ the equilibrium is unique and in semi-mixed strategies. It entails the (expected) effort levels

$$x_1 = \frac{w}{r}(r-1)^{\frac{r-1}{r}} \quad \text{and} \quad E(x_2) = \frac{w^2}{r}(r-1)^{\frac{r-1}{r}},$$

winning probabilities

$$p_1 = 1 - \frac{w}{r}(r-1)^{\frac{r-1}{r}} \quad \text{and} \quad p_2 = \frac{w}{r}(r-1)^{\frac{r-1}{r}},$$

expected aggregate effort

$$E(X) = \frac{w(1+w)}{r}(r-1)^{\frac{r-1}{r}}, \tag{7}$$

[7] The analysis is the same for both parties. Therefore, here and below, we omit the superscript P wherever confusion can be excluded.

and expected aggregate investment

$$E(I) = \frac{2w}{r}(r-1)^{\frac{r-1}{r}} = \frac{2}{1+w}E(X). \tag{8}$$

Notice that in this range, the winning probability of the stronger applicant, p_1, is an increasing function of r and the expected aggregate effort, $E(X)$, is a decreasing function of r.

Finally, for $r > 2$ all equilibria are in mixed-strategies and equivalent to the unique equilibrium of the all-pay auction (APA) with respect to expected efforts, winning probabilities, and payoffs. We call this an APA-equilibrium. It entails the expected effort levels

$$E(x_1) = \frac{w}{2} \quad \text{and} \quad E(x_2) = \frac{w^2}{2},$$

winning probabilities

$$p_1 = 1 - \frac{w}{2} \quad \text{and} \quad p_2 = \frac{w}{2},$$

expected aggregate effort

$$E(X) = \frac{w(1+w)}{2}, \tag{9}$$

and expected aggregate investment

$$E(I) = w = \frac{2}{1+w}E(X). \tag{10}$$

4.3 First Stage: Accuracy Choice

Anticipating the applicants' behavior during the primaries and the candidates' behavior during the general election, the board of each party P chooses the accuracy level for its primary election r^P in order to maximize the own candidate's expected success probability in the general election. Using equation (4), the expected success probability of party A's candidate in the general election is given by

$$\begin{aligned}
E(\pi^A) = {} & p_1^A p_1^B E\left[\frac{(R^A - I^A)}{(R^A - I^A) + (R^B - I^B)} \mid 1 \text{ wins in } A, 1 \text{ wins in } B\right] \\
& + p_1^A p_2^B E\left[\frac{(R^A - I^A)}{(R^A - I^A) + w^B(R^B - I^B)} \mid 1 \text{ wins in } A, 2 \text{ wins in } B\right] \\
& + (1 - p_1^A) p_1^B E\left[\frac{w^A(R^A - I^A)}{w^A(R^A - I^A) + (R^B - I^B)} \mid 2 \text{ wins in } A, 1 \text{ wins in } B\right] \\
& + (1 - p_1^A) p_2^B E\left[\frac{w^A(R^A - I^A)}{w^A(R^A - I^A) + w^B(R^B - I^B)} \mid 2 \text{ wins in } A, 2 \text{ wins in } B\right],
\end{aligned} \tag{11}$$

where (conditional) expectations are based on the distributions specifying the (potentially) mixed-strategies in the equilibria of the primaries.[8]

The objective function (11) reflects a complex strategic decision problem. In general, party A's optimal choice of the accuracy level r^A may not only depend on the exogenous parameters of the model but also on party B's choice of the accuracy level r^B. We can show, however, that party A's best response to any choice of r^B will be polarized: party A always chooses an accuracy level r^A either (weakly) above the upper threshold, 2, or strictly below some lower threshold, r_H, with $r_H < 2$, and so this holds in equilibrium as well.

To see this, notice that I^A and p_1^A do not explicitly depend on r^B. Moreover, $\partial E(\pi^A)/\partial I^A < 0$ and $\partial E(\pi^A)/\partial p_1^A > 0$ for all r^B, as straightforward calculations show. For any given r^B, the maximization of $E(\pi^A)$ by the choice of r^A thus entails two (possibly conflicting) objectives: the maximization of the strong applicant's selection probability p_1^A and the minimization of aggregate primary investment I^A, which is, in equilibrium, equivalent to the minimization of aggregate primary effort X^A. Ewerhart (2017*b*, Table 1) observes that for any given w^A both, p_1^A and X^A are continuous functions of r^A. While $\partial p_1^A/\partial r^A > 0$ for all $0 \leq r^A < 2$ and $\partial p_1^A/\partial r^A = 0$ for all $r^A \geq 2$ (Ewerhart 2017*b*, Table 1), aggregate effort X^A is an inverted U-shaped function of r^A with a unique maximum in the region of pure-strategy equilibria where $r^A \leq 1 + (w^A)^{r^A}$ (Sahm 2022, Proposition 2).

The objective function (11) thus entails a trade-off between selection quality and minimum aggregate effort. The work by Sahm (2022) then implies that party A optimally solves this trade-off by choosing either an all-pay auction equivalent, i.e., $r^A \geq 2$, or an accuracy level $r^A < r_H$, where r_H depends on w^A and equates aggregate effort in the pure-strategy equilibrium according to equation (5) and expected aggregate effort of the all-pay auction equilibrium according to equation (9), i.e., r_H solves

$$\frac{r(w^A)^r(1+w^A)}{(1+(w^A)^r)^2} = \frac{(1+w^A)w^A}{2} \quad \Leftrightarrow \quad H(w^A, r) := (1+(w^A)^r)^2 - 2r(w^A)^{r-1} = 0.$$

Notice that $r_H \leq 2$ for all w^A. Symmetric arguments also apply to party B. This yields

Proposition 1 *Each party $P \in \{A, B\}$ chooses a polarized design for its primary election: in equilibrium, the accuracy is either low ($r^P < r_H$) or maximum ($r^P \geq 2$).*

[8]For example, in the range in which $r^P \leq (w^P)^{r^P}$ for $P \in \{A, B\}$, we have

$$\begin{aligned} E(\pi^A) &= p_1^A p_1^B \frac{(R^A - I^A)}{(R^A - I^A) + (R^B - I^B)} + p_1^A p_2^B \frac{(R^A - I^A)}{(R^A - I^A) + w^B(R^B - I^B)} \\ &+ (1-p_1^A)p_1^B \frac{w^A(R^A - I^A)}{w^A(R^A - I^A) + (R^B - I^B)} + (1-p_1^A)p_2^B \frac{w^A(R^A - I^A)}{w^A(R^A - I^A) + w^B(R^B - I^B)}. \end{aligned}$$

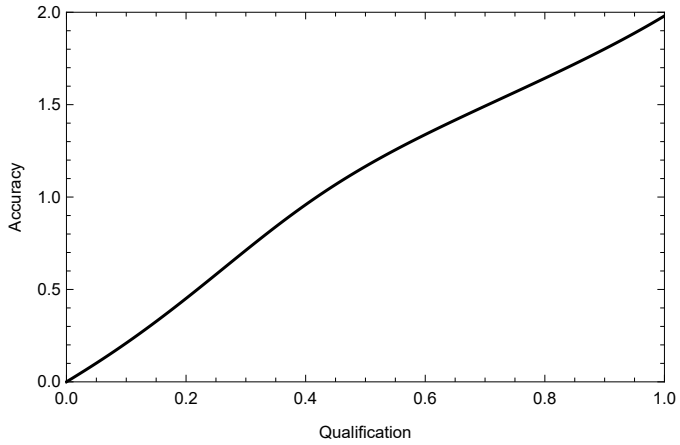

Figure 2: Lower threshold r_H as a function of the qualification ratio w^P.

Figure (2) illustrates how the lower threshold r_H depends on the ratio of the applicants' qualifications w^P within the respective party: the graph represents all combinations satisfying $H(w^P, r_H) = 0$. Notice that if it is optimal to choose a low accuracy, r_H is indeed only an upper bound for this choice because it yields the same aggregate effort as the all-pay auction but a reduced selection quality. To compensate for the reduced selection quality, the optimal accuracy must reduce aggregate effort (not only marginally but) significantly and thus has to be (not only marginally but) significantly smaller than r_H. For instance, if the two candidates of party P have the same qualification ($w^P = 1$), obviously, a purely random primary is optimal, i.e., $r^P = 0 \ll 2 = r_H(1)$. The examples of the following section illustrate that such a complete polarization is rather the rule than the exception.

5 Competing against an Incumbent

To further illustrate the basic trade-off between maximum selection quality and minimum aggregate effort in the primary election and to determine the optimal choice of the respective accuracy level, we now restrict the analysis to party A competing against an incumbent from party B. As before, party A uses a primary election to select one of two applicants $i \in \{1, 2\}$ as its candidate in the subsequent general election. In contrast, party $B = IN$ forgoes the primary election and directly nominates the incumbent as its candidate for the general election.[9] This setting applies, for example, to the US election system when the incumbent president is, at the end of the first term, usually also the party's nominee for the upcoming general election.

We assume that both, the incumbent's qualification v^{IN} and resources R^{IN} are com-

[9] An alternative interpretation would be that the incumbent party only designs a primary election "pro forma", to officially nominate the only applicant as their candidate.

monly known. Accordingly, party A's objective function (11) reduces to:

$$E(\pi^A) = p_1^A E\left[\frac{(R^A - I^A)}{(R^A - I^A) + v^{IN}R^{IN}} \mid 1 \text{ wins in } A\right] + (1 - p_1^A)E\left[\frac{w^A(R^A - I^A)}{w^A(R^A - I^A) + v^{IN}R^{IN}} \mid 2 \text{ wins in } A\right]. \quad (12)$$

In the first subsection, we fix $v^{IN}R^{IN} = 1.5$ and numerically determine party A's optimal choice of the accuracy level as a function of the qualification ratio w^A of its applicants.[10] In the second subsection, we examine how this optimal accuracy choice responds to variations in the incumbent's qualification and budget on the one hand, and party A's own budget on the other.

5.1 Numerical solution

According to Proposition 1, the optimal accuracy level r^A satisfies either $r^A < r_H(w^A)$ or $r^A \geq 2$. We first determine the optimal *low* accuracy level, i.e., the accuracy level r_ℓ^A that maximizes equation (12) subject to $r_\ell^A \leq r_H(w^A)$. We then compare the resulting expected success probability $E(\pi^A)$ with the expected success probability that results from choosing a *high* accuracy level $r^A \geq 2$.

5.1.1 Optimal low accuracy level

Figure 3 illustrates the optimal low accuracy level r_ℓ^A as a function of the qualification ratio w^A for $R^A = 1.5$. If this ratio exceeds a certain threshold level $\tilde{w} \approx 0.32$, the optimal low accuracy is $r_\ell^A = 0$. Put differently, if the applicants' qualifications are sufficiently close, a purely random selection of the candidate is optimal as it preserves all the party's resources for the subsequent general election. For more heterogeneous qualifications $w^A < \tilde{w}$, however, the optimal low accuracy is positive, $0 < r_\ell^A \leq r_H(w^A)$. Investing some resources increases the probability of selecting the strong applicant as the party's candidate and therefore pays off in the general election.

5.1.2 Comparison of optimal low and high accuracy level

The pink line in Figure 4 depicts the expected success probability $E(\pi^A)$ resulting from the optimal low accuracy level $r_\ell^A \leq r_H(w^A)$ as a function of the qualification ratio w^A of party A's applicants. The success probability is increasing in w^A because the disadvantage of selecting the weaker applicant is the smaller the less the applicants' qualifications differ.

Instead, if party A chooses a high accuracy level $r^A \geq 2$, this implies an APA equilibrium in its primary election. The resulting success probability in the general election

[10] For all numerical computations and graphical illustrations below, we used the software *Mathematica*. The respective source files are available from the authors on request.

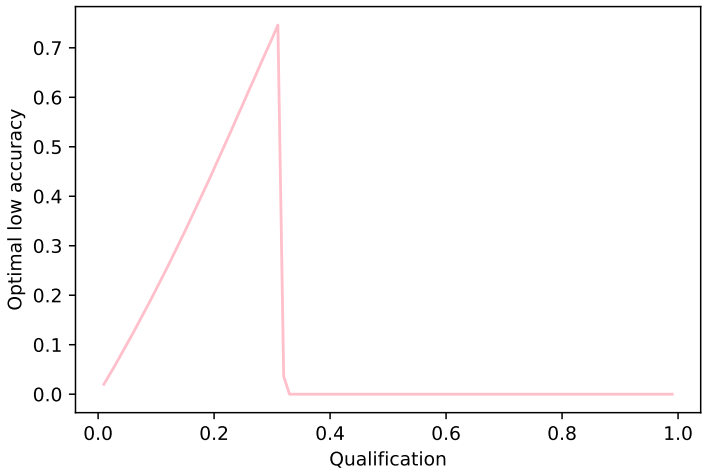

Figure 3: Optimal low accuracy (for $R^A = v^{IN} R^{IN} = 1.5$).

is illustrated by the black line in Figure 4. Obviously, the success probability in an APA equilibrium is a decreasing function of the qualification ratio w^A because the primary election absorbs the more resources the closer the contest between the applicants of party A gets.

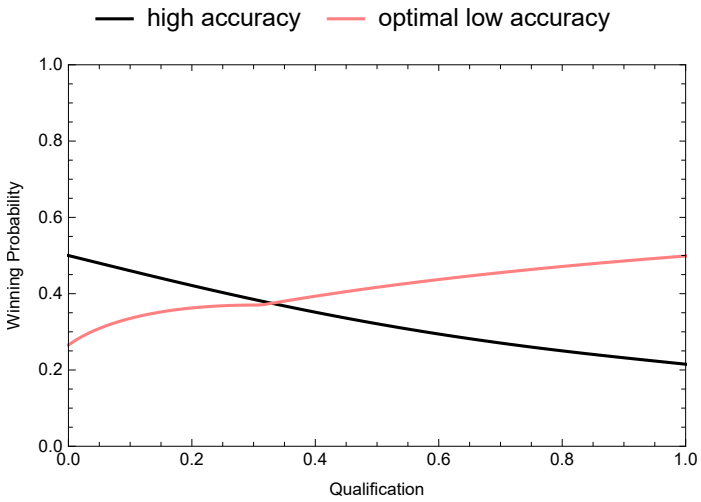

Figure 4: Maximum winning probability (for $R^A = v^{IN} R^{IN} = 1.5$).

As Figure 4 shows, the current specification of the model leads to a unique intersection of the pink and the black line at a certain qualification ratio $\hat{w} \approx 0.34$. To the right of this threshold, i.e., for $w^A \geq \hat{w}$, party A maximizes its expected success probability in the general election by implementing a primary election with the optimal low accuracy level. Notice, however, that this optimal accuracy level is $r^A = 0$ in this range since $\hat{w} > \tilde{w}$. By contrast, to the left of the intersection, i.e., for $w^A < \hat{w}$, party A optimally chooses a high accuracy level $r^A \geq 2$ that implies an APA equilibrium in the primary election. These findings are intuitive: For high qualification ratios, saving resources is more important

than an accurate selection because the applicants' qualifications are close anyway. Instead, for low qualification ratios, the increased chances of a highly qualified candidate due to a more accurate selection offsets the decrease of available resources resulting from an intense primary election.

Interestingly, party A's equilibrium expected success probability in the general election is not a monotonic but U-shaped function of the qualification ratio w with a minimum at the threshold qualification ratio $\hat{w}$. On the one hand, compared to complete heterogeneity, an intermediate level of heterogeneity intensifies competition and consumes more resources given that the selection process is highly accurate. On the other hand, compared to complete homogeneity, an intermediate level of heterogeneity decreases the expected qualification of the selected candidate given that the selection process is purely random. We summarize our observations in

Numerical Result 1 *Competing against an incumbent IN with $v^{IN}R^{IN} = 1.5$, party A with $R^A = 1.5$ designs a completely polarized primary election: it is optimal to choose*

(a) maximum accuracy $r^A \geq 2$ if $w^A < \hat{w}$,

(b) minimum accuracy $r = 0$ if $w^A \geq \hat{w}$.

In equilibrium, party A's expected success probability in the general election $E(\pi^A)$ is a U-shaped function of the qualification ratio w^A that reaches its minimum at $\hat{w}$.

5.2 Comparative statics

In this section we illustrate how variations of different parameter values effect our results.

5.2.1 Incumbency

We first consider a variation in the strength of the incumbent from party B. Figure 5 illustrates the comparison between party A's equilibrium winning probabilities facing a weak incumbent, with $v^{IN}R^{IN} = 1.5$, and a strong incumbent, with $v^{IN}R^{IN} = 4$, respectively. Obviously, party A's expected winning probability, $E(\pi^A)$, will be higher if the incumbent is weaker. However, there is no difference with respect to the optimal primary design of party A. Regardless of the incumbent's strength, party A faces the same threshold level $\hat{w}$ below which it is optimal to choose maximum accuracy. Intuitively, party A seeks to maximize its expected impact in the general election regardless of the opponent's strength.

5.2.2 Party resources and independent candidates

By contrast, a change in a party's resources or the independence of its candidates leads to a different optimal primary design, i.e., a change in the threshold level $\hat{w}$.

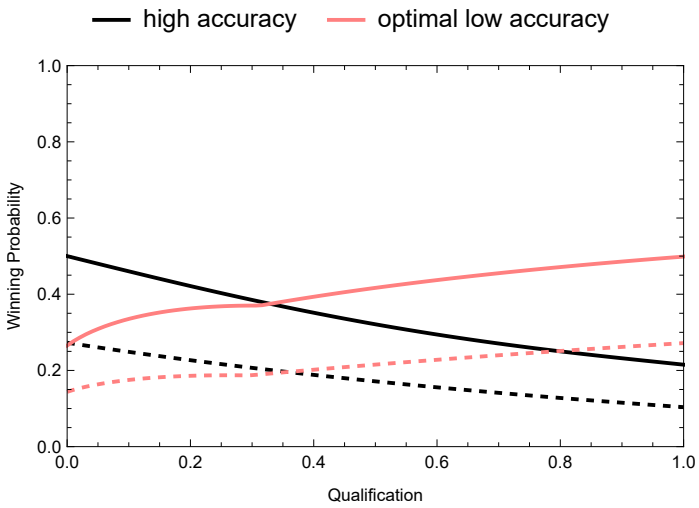

Figure 5: Weak ($v^{IN}R^{IN} = 1.5$, solid) versus strong ($v^{IN}R^{IN} = 4$, dashed) incumbent.

For example, consider a situation where the initial resources of party A are scarcer. This shifts the emphasis in the trade-off party A faces from high selection quality to low contest intensity: the scarcer the party's budget, the more important it is to save on resources during the primary. Figure 6 illustrates the effect of a change in resources regarding the primary design, from high budget, $R^A = 4$, to low budget, $R^A = 1.5$. First, it is straightforward to see that the expected probability of winning, $E(\pi^A)$, will be smaller if the budget is lower. Second, the threshold $\hat{w}$ will also be smaller if the budget is lower, i.e., $\hat{w}_{R^A=1.5} < \hat{w}_{R^A=4}$. Intuitively, if a party's budget is sufficiently high, the party can afford a high primary intensity to increase selection quality. Vice versa, if the budget is low, a party only implements a highly accurate primary for very steep qualification differences. Therefore, a decrease in the budget leads to a decrease in $\hat{w}$.

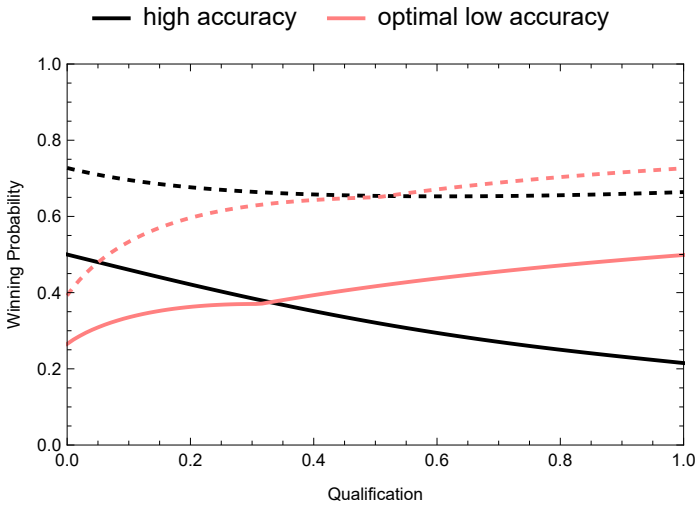

Figure 6: Low budget ($R^A = 1.5$, solid) versus high budget ($R^A = 4$, dashed).

A similar argument can be made for primaries in which the applicants are partially

independent in the sense that their investments do not fully deplete their party's resources.[11] The applicants' independence of party resources can be captured by some parameter $\delta \in [0, 1]$ specifying the party's remaining budget

$$B^A = R^A - \delta(c_1 x_1 + c_2 x_2).$$

For example, if applicants fully rely on their own resources, this will imply $\delta = 0$. The effect of a change in δ is congruent to a change in R^A. Therefore, as the applicants' independence increases, i.e., δ decreases, the threshold $\hat{w}$ increases because the budget is less constrained. In the extreme case of complete independence from party resources, $\delta = 0$, it is always optimal for a party to implement a primary with maximum accuracy because the trade-off between selection quality and contest intensity is eliminated.[12]

6 Career Concerns and Political Polarization

In this section, we consider a variant of the model assuming more farsighted applicants who take into account the continuation value of potentially winning the general election after a successful primary. Based on this extension with career concerns, we illustrate that a reinterpretation of the applicants' cost parameters can explain differences in a primary's accuracy as a consequence of political polarization within parties. To facilitate the analysis, we stick to the case of party A competing against an incumbent with an exogenous impact y^{IN} in the general election. Below, we omit the superscript for the variables of party A.

6.1 Career concerns

So far, we have assumed that applicants are myopic in the sense that they only value becoming the party's candidate but do not derive any additional utility from the associated possibility of winning the subsequent general election. In contrast, we now assume that applicants have career concerns and (only) value the chance that winning the primary will give them the opportunity to win the subsequent general election. Equation (3), which describes applicant 1's expected utility from investing effort x_1 in the primary, thus has to be modified as follows:

$$Eu_1 = p_1 \pi_1 - c_1 x_1 \quad \text{or, equivalently,} \quad EU_1 = p_1 v_1 \pi_1 - x_1, \tag{13}$$

[11] For simplicity, assume that applicants are equally independent and symmetric with respect to own resources.

[12] This result may explain country-specific differences in party politics: in the US, applicants mainly pay by themselves when they participate in the primaries, so parties can afford to use a long and intense selection process; in the German system, primaries are mainly paid out of the party's budget, so the trade-off is more severe.

where

$$\pi_1 = \frac{R - c_1 x_1 - c_2 x_2}{R - c_1 x_1 - c_2 x_2 + c_1 y^{IN}}$$

denotes applicant 1's probability of winning the general election according to equation (4). Analogously,

$$EU_2 = p_2 v_2 \pi_2 - x_2 \quad \text{and} \quad \pi_2 = \frac{R - c_1 x_1 - c_2 x_2}{R - c_1 x_1 - c_2 x_2 + c_2 y^{IN}}.$$

The modified game is strategically more complex because the effective valuations of winning the primary, $v_i \pi_i$, now also depend on the investments x_1 and x_2.[13] However, $c_1 < c_2$ implies $\pi_1 > \pi_2$ and thus $v_1 \pi_1 > v_2 \pi_2$ for all x_1 and x_2. Put differently, as in the baseline model above, the effective valuation of the more qualified applicant is always larger than that of the less qualified applicant. In this sense, the structure of the strategic decision problems faced by the applicants in the primary remains the same. Accordingly, when choosing the accuracy r of the primary, the party board still faces an analog trade-off between selection quality and resource dissipation.

6.2 Political polarization

Up to now, we have interpreted the applicants' heterogeneous costs as a form of vertical differentiation with respect to their qualifications. Assuming that applicants have career concerns and that their effort costs may differ between the primary and the general election, also allows for interpreting their heterogeneity as a form of horizontal differentiation that describes their political polarization.[14]

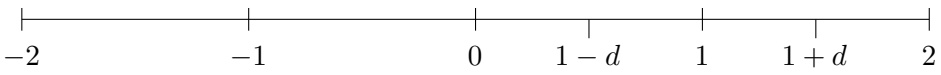

Figure 7: Reinterpreting the applicants' heterogeneity as political polarization.

On a Hotelling-line from -2 to 2, voters (in the general election) are centered around 0, but members (i.e., voters in the primary) of party A (B) are centered around 1 (-1). Parameter $d \in [0, 1]$ expresses the applicants' heterogeneity as a measure of political polarization: $1 - d$ describes the position of applicant 1, whereas $1 + d$ describes the

[13] Notice that this dependency yields additional incentives to reduce investments for both applicants as

$$\frac{\partial \pi_i}{\partial x_i} = -\frac{c_i y^{IN}}{(R - c_1 x_- c_2 x_2 + c_i y^{IN})^2}.$$

Since straightforward calculations show that $|\frac{\partial \pi_1}{\partial x_1}| < |\frac{\partial \pi_2}{\partial x_2}|$ for all x_1 and x_2, the marginal disincentives are always stronger for the weaker applicant.

[14] Alternatively, the political polarization discussed below may be understood as the extent of (inverse) party unity or the difference between party members' ideology.

position of applicant 2. Assume that the applicants' investment costs differ between the primary and the general election and are equal to 1 plus the distance to the decisive (median) voter of the respective election. Hence, the two applicants' investment costs in the primary are identical and equal to $k_i = 1 + d$. Their investment costs in the general election, however, differ – the more so the larger their political polarization d: applicant 1 has lower costs than applicant 2, $c_1 = 2 - d < 2 + d = c_2$.

Similar to the previous subsection, applicant 1's expected utility from investing effort x_1 in the primary is then given by

$$Eu_1 = p_1\pi_1 - (1+d)x_1 \quad \text{or, equivalently,} \quad EU_1 = p_1 v\pi_1 - x_1,$$

where $v = \frac{1}{1+d}$ and

$$\pi_1 = \frac{R - (1+d)(x_1+x_2)}{R - (1+d)(x_1+x_2) + (2-d)y^{IN}}.$$

Analogously,

$$EU_2 = p_2 v\pi_2 - x_2 \quad \text{and} \quad \pi_2 = \frac{R - (1+d)(x_1+x_2)}{R - (1+d)(x_1+x_2) + (2+d)y^{IN}}.$$

As above, $c_1 < c_2$ implies $\pi_1 > \pi_2$ and thus $v\pi_1 > v\pi_2$ for all x_1 and x_2. In virtue of our alternative interpretation, the effective valuation of the moderate (less polarized) applicant is always larger than that of the extremist (more polarized) applicant and, in this sense, the structure of the applicants' strategic decision problems remains the same. Accordingly, when choosing the accuracy r of the primary, the party board faces an analog trade-off between a suitable selection and the saving of resources.

More generally, the parameter describing the applicants' cost (or ability as the inverse thereof) may have various dimensions and interpretations relating to real resources (like time or money) or immaterial ones (like party unity or political polarization). Our examples, in which we alternatively interpret the parameter as qualification or political polarization, illustrate that the implications of the applicants' heterogeneity depend neither on its exact interpretation nor on whether it gives rise to vertical or horizontal differentiation.

7 Extensions

We now consider various further extensions of our model. In particular, we argue that the basic results and mechanism still hold for other model specifications such as a larger number of parties or candidates and different information structures.

7.1 Multiple parties

Our baseline model assumes only two parties, which is a valid description of the situation in countries such as the U.S. in which, in effect, a two-party system prevails. In many other democracies, however, more than two parties compete in the general election.[15] With $n \in \mathbb{N}$ different parties, the probability of party P's candidate winning the general election becomes

$$\pi^P = \frac{y^P}{y^P + \sum_{j \neq p}^{n} y^j}. \tag{14}$$

Thus, a larger number of parties will, ceteris paribus, increase competition and decrease party P's winning probability. Similar to the comparative statics of Section 5.2.1, however, the (trade-off determining the) optimal level of a primary's accuracy remains unaffected by the number of competing parties. The intuition is, as above, that a party seeks to maximize its expected impact in the general election regardless of the strength or number of competitors.

7.2 Multiple applicants

By nature, intra-party competition often features the dispute between two leading members. And even if there are more applicants to begin with, in practice, primaries usually boil down to a contest between the two most promising aspirants later on.[16] These situations are well-captured by our model assuming only two applicants per party.

The formal treatment of more than two (heterogeneous) applicants per party faces some technical problems. For $N \in \mathbb{N}$ potential applicants within a party with given qualifications $v_1 \geq v_2 \geq \ldots \geq v_N$, a unique pure-strategy Nash equilibrium of the respective primary exists only if $r \leq 1$ (see Stein 2002, Cornes & Hartley 2005, Matros 2006). If $r > 1$, but still sufficiently low, several pure-strategy Nash equilibria exist (see Ryvkin 2007), even if players are symmetric (see Perez-Castrillo & Verdier 1992). For $r \geq 2$, an APA-equilibrium always exists (see Alcalde & Dahm 2010), and any (mixed-strategy) Nash equilibrium is an APA-equilibrium if r is sufficiently large (see Ewerhart 2017*a*). For any given $N \in \mathbb{N}$ and $r \geq 2$, however, there are qualifications $v_1 \geq v_2 \geq \ldots \geq v_N$ such that a non-APA-equilibrium exists as well (see Ewerhart 2017*a*). Thus, we are not only confronted with the issue of multiple equilibria. An additional problem is that in the range where multiple equilibria exist, the set of Nash equilibria has not yet been fully

[15] For example, after the general election in 2021, members of eight different parties entered the German parliament (Bundestag) and thus had the right to vote in the election of the Federal Chancellor. Three of the parties nominated an own candidate with a reasonable chance for chancellorship.

[16] Intra-party elections are often organized in stages. For example, in the U.S. both, the democratic and republican party organize their primaries in the different federal states in a (partially) sequential order. Candidates who are unsuccessful in states with early primaries usually stop their campaign and drop out of the races in later states.

characterized in the literature.

One way to circumvent these problems is to restrict the search for an optimal accuracy r to the range of unique equilibria, i.e., $r \leq 1$, or r sufficiently large to enforce an APA-equilibrium. The above analysis of the case with two applicants suggests that this is the relevant range, anyway.

On the one hand, if r is chosen sufficiently large to enforce an APA-equilibrium, only the two strongest applicants are active and the equilibrium values are the same as in the above analysis with only two applicants (see Hillman & Riley 1989). On the other hand, for $r = 1$ Matros (2006) shows that the $K \leq N$ strongest applicants are active in the unique pure-strategy Nash equilibrium, and the number of applicants N (weakly) increases aggregate effort but decreases individual winning probabilities.

A higher number of applicants thus aggravates the trade-off between selection quality and resource dissipation and leads to an even more polarized accuracy choice in the following sense: Whenever an accuracy r that enforces an APA-equilibrium is preferred over any $r \leq 1$ with two applicants, it is, a fortiori, also preferred with more than two applicants. By contrast, if the optimal accuracy with two applicants is some $r^* \leq 1$, then, with more than two applicants, the party board will either find an accuracy r that enforces an APA-equilibrium more preferable or optimally choose some $r^{**} \leq r^*$.

7.3 Alternative Information Structure

The timing of events considered so far (see Figure 1) reflects the implicit assumption that the party board is able to adjust the accuracy in response to realized differences in the applicants' qualification from primary to primary on short notice. However, in some cases, such as the U.S., long-standing habits shape the design of the primaries and changes may only materialize in the long run. The alternative timeline in Figure 8 then better captures the true sequence of events: now the party board chooses the accuracy for its primary before the applicants draw their qualifications. Obviously, the decision on the accuracy of the primary must then be based on the expected rather than the realized differences in the applicants' qualifications. This makes the formal analysis more involved but does not alter the basic trade-off between selection quality and resource dissipation.

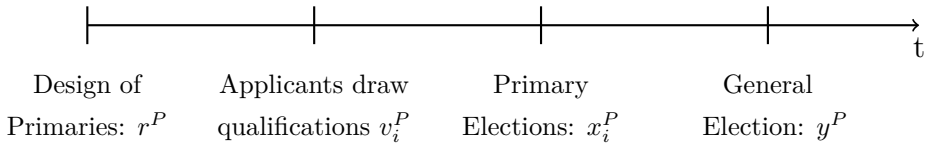

Figure 8: Alternative Timeline.

8 Conclusion

We have studied intra-party contests, such as the US primaries, which are often used to select a candidate for a subsequent cross-party election. A more accurate selection may improve the quality of the candidate but detract more resources from the subsequent campaign. We have modeled this trade-off as a problem of contest design and shown that extreme accuracy levels are optimal: maximum accuracy if the potential candidates are (expected to be) sufficiently heterogeneous, and a highly random selection otherwise.

Various extensions of the model suggest that, qualitatively, these findings do not depend on the exact number of political parties, applicants per party, the information structure, or whether applicants are myopic or far sighted. The heterogeneity among applicants may not only be interpreted as differing qualifications in a vertical sense but also as political polarization in a horizontal sense. Our results explain varying primary designs on a local as well as on a global level and shed light upon the paradox of limited competition within democratic parties.

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