Identity Focus in Political Campaigns *

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Abstract

We model identity politics as an endogenous information-jamming device. Candidates choose between identity rhetoric, which yields a vote premium but conceals quality, and programmatic campaigning, which sacrifices the premium but enables quality revelation. When one candidate employs identity rhetoric while the rival campaigns on substance, cross-talk degrades the rival's programmatic message. This information externality makes identity rhetoric a strategic substitute, explaining why minority candidates optimally respond to majoritarian identity appeals with programmatic campaigns. Identity politics reduces voter welfare by lowering expected candidate quality, generating majoritarian bias in selection errors, and degrading selection efficiency, the electorate's ability to choose superior candidates.

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All errors that remain are the authors' responsibility.

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1 Introduction

Political parties in many democracies have built electoral platforms around the identity of the demographic majority.[1] The dimension along which the majority is constructed varies (religion in India, Sri Lanka, and Türkiye; ethnicity in Poland, and Hungary; race in the United States), but majoritarian identity appeals have proved electorally potent across these settings. The opposition's response, however, has not been uniform. In some cases, minority or opposition candidates have responded in kind, with "ethnic outbidding" (Chandra, 2005). In others, they have de-emphasized identity, building campaigns around programmatic, policy-focused platforms. The Democratic Party in the United States has built its recent electoral strategy around policy and coalition-building across minority groups; in India, the principal opposition parties have campaigned on governance and development rather than counter-mobilizing along minority religious identity. This raises a question that existing accounts leave open: when confronted with majoritarian identity politics, do minority parties respond by intensifying identity appeals or by shifting toward programmatic politics? Theoretically, is identity politics strategically complementary or strategically substitutable?

We develop a model of electoral campaigns. Two candidates, one from the majority group and one from the minority, simultaneously choose between identity-focused and programmatic rhetoric. Real campaigns might mix the two themes, here the binary choice stands in for the theme a campaign leads with. The quality of the candidate represents competence or policy utility for voters from the candidate after winning. Each candidate's quality is private information, drawn independently from a common prior distribution. Identity rhetoric yields electoral premium from in-group voters but reveals nothing about quality to the electorate. Programmatic rhetoric sacrifices this identity premium but enables public learning about competence. The candidates, low-quality types prefer to hide behind identity rhetoric, while high-quality types prefer programmatic campaigns that can reveal their competence.

The information-revelation protocol is an important modeling innovation. Informativeness of a campaign message depends on the *profile* of both campaigns instead of being fixed. When both candidates adopt programmatic rhetoric, public discourse coordinates on policy, qualities of both candidates are fully revealed. When one candidate uses identity rhetoric while the rival runs a programmatic campaign, discourse is split across two dimensions, producing what we call *cross-talk*: the programmatic candidate's quality is

[1] A large empirical literature documents the persistence of identity-based voting across democratic contexts: ethnicity and race in the US (Wolfinger, 1965, Ganuthula and Balaraman, 2025) and Africa (Posner, 2005, Eifert et al., 2010, Adida, 2015), caste and religion in India (Chandra, 2007, Heath et al., 2015, Vaishnav, 2025), and ethno-cultural identity in Europe (Ansolabehere and Puy, 2016, Mader et al., 2021).

revealed to voters only with some probability strictly between zero and one. When both employ identity rhetoric, no quality information reaches voters. Cross-talk has a simple reading: when campaigns address different dimensions, public discussion cannot coordinate on a single issue, and the programmatic message is partially crowded out by the identity campaign.[2]

In the formal literature on identity and political economy, identity typically shapes behavior through preferences while the information environment remains exogenous. Akerlof and Kranton (2000) and Shayo (2009) model identity as a preference weight that directly alters voting. Dickson and Scheve (2006) show that social-identity concerns can drive platform divergence.[3] We depart from this by modeling identity rhetoric instead as an *informational externality*, connecting preference-based identity politics with the theoretical literature on strategic ambiguity and information design. Early work establishes that candidates may employ ambiguous platforms to hide their true preferences (Alesina and Cukierman, 1990, Aragones and Postlewaite, 2002), and Bayesian persuasion models demonstrate how politicians strategically control information to influence voters (Kamenica and Gentzkow, 2011, Alonso and Câmara, 2016). We contribute to this tradition by showing that ambiguity is not necessarily a feature of a single candidate's platform. Rather, identity politics acts as an information-jamming device in campaign cross-talks: the uninformative but utility-bearing signal of one candidate actively degrades the electorate's ability to learn about the rival's quality. Voters remain fully rational Bayesians; the distortion acts on the information they receive, not on how they process it. By making the informativeness of public discourse endogenous to the candidates' joint choices, cross-talk transforms identity rhetoric into a tool for strategic obfuscation.

Equilibrium strategies take a cutoff form. Each candidate has a quality threshold: types below the threshold engage in identity politics, types above use programmatic plank. Thus, the propensity to engage in identity politics is ex-ante probability of having type below the cutoff and the propensity to conceal the quality information or to engage in programmatic politics is the ex-ante probability of having type above the cutoff. These cutoffs are strategic substitutes. When one candidate raises her cutoff, increasing propensity to engage in identity politics, the rival's equilibrium cutoff falls. The

[2]Similarly Egorov (2015) assumes that voters learn more when the two candidates campaign on the same issue than on different ones, and Bhattacharya (2016) uses a related structure for positive and negative campaigning. Our setting differs in both structure and substance. The tradeoff we study is between identity and programmatic appeals, and the demographic asymmetry across candidates delivers a different set of results.

[3]A related strand of comparative politics literature studies the institutional determinants of programmatic versus clientelistic linkages; see Kitschelt and Wilkinson (2007), Stokes et al. (2013), Bardhan and Mookherjee (2018), and Sarkar (2018). Our model complements this work by identifying an informational channel through which programmatic politics emerges as an equilibrium response to identity campaigning, distinct from institutional or redistributive explanations.

mechanism operates through the imperfect information revelation channel. When one candidate relies more on identity rhetoric, the other candidate is presented with an opportunity to make untested claims about herself with a programmatic plank. Suppose the majority candidate raises her threshold, playing identity more frequently. When the minority candidate chooses programmatic rhetoric, cross-talk now occurs more often. In each cross-talk event, the minority's quality goes unrevealed with positive probability. Voters then evaluate the minority candidate at the conditional mean of all types above the minority's threshold, which exceeds the threshold itself. For moderate minority types, those just above the threshold, this pooling with higher-quality types is beneficial: they are evaluated above their true, relatively modest quality. The payoff from programmatic politics rises at the margin, the previous threshold type's indifference breaks in favor of revelation, and the minority's cutoff falls. If programmatic messages always revealed quality perfectly, each candidate's cutoff would depend only on her own identity benefit, and the two strategies would be independent. The strategic interaction arises entirely from the imperfection of public discourse under cross-talk.

Whether identity politics is a substitute or a complement depends on the channel through which it operates, and we do not claim that substitutability is intrinsic to it. Any model where common identity functions as a mode of voter mobilization can generate complementarity: one group mobilizing more agents will force the other to mobilize more (Chandra, 2005). Studies like Eifert et al. (2010), Chandra (2007), which examine electoral competition between ethnic coalitions, can be read in this light. There is another literature on redistributive conflict between groups that models political competition as a contest where the ratio of group sizes becomes a crucial determinant of political effort and win probabilities. In such models, effort is a strategic substitute for the smaller group and a strategic complement for the larger group. In this vein, Mitra and Ray (2014) studies Hindu-Muslim conflict in India and shows that there is an escalation of violence in districts where Muslim per capita expenditures increase, but there is no such effect when Hindu per capita spending rises. In our model, the information-jamming channel ensures that identity politics serves as a strategic substitute for both the minority and the majority. The minority's adoption of programmatic politics is thus an active best response to the strategic opportunities that the majority's information jamming creates rather than a passive "fallback" option born of numerical weakness.

In equilibrium, the majority candidate engages in identity rhetoric more frequently than the minority candidate. This asymmetry is rooted in demographic structure. Because the majority candidate mobilizes a larger in-group base, identity rhetoric generates a larger electoral return for the majority. Moreover, as the majority grows larger, the majority candidate has a stronger incentive to rely on identity rhetoric. First, with the direct effect, the number advantage now favors her more, and the strategic channel forces minority candidate to programmatic plank, which further reinforces higher identity politics for majority candidate. As a result, demographic asymmetries can generate a self-reinforcing equilibrium in which the majority increasingly campaigns on identity while the minority increasingly emphasizes programs and policy. Greater campaign informativeness reduces this asymmetry by limiting the scope for information jamming, but does not eliminate it entirely. The prediction that larger groups rely more heavily on identity-based mobilization is consistent with empirical evidence from ethnic politics (Posner, 2005, Eifert et al., 2010); in Ticku and Venkatesh (2025), a majoritarian party that invests in polarizing identity 'substitutes away from economic policy in equilibrium'.

Our welfare analysis show that identity politics as an information-jamming device affects society in three distinct ways. First, identity politics reduces the expected quality of the elected candidate below the full-information benchmark in which voters always observe candidate quality. Next, selection efficiency, the electorate's ability to choose the better candidate or equivalently the probability that the higher-quality candidate wins, is also strictly lower than under full information. The two criteria are distinct: expected quality penalizes a selection error in proportion to the quality gap it wastes, whereas selection efficiency counts every error equally. Lastly, those errors are asymmetric. They systematically favor the majority candidate, so there is a majoritarian bias in candidate selection; this bias is absent under full information.

One might expect that better media scrutiny, by making cross-talk more informative, would mitigate these costs. The answer is ambiguous. Higher informativeness directly improves quality revelation in cross-talk, which mechanically reduces welfare loss. But higher informativeness also sharpens the revelation risk for intermediate-quality types. As the probability of being evaluated at one's true, mediocre quality rises, the marginal type retreats into identity rhetoric. The minority candidate always raises her cutoff in response to higher campaign informativeness, and under certain parameter configurations, so does the majority candidate. The net welfare effect can go in either direction. This finding parallels Prat (2005), where greater transparency reduces equilibrium information provision by distorting agent incentives. In Prat's framework, the agent distorts the policy action being observed in order to appear competent. In our model, quality is exogenous and cannot be manipulated. Candidates choose the campaign platform and hence control whether quality information enters public discourse. Field evidence is also consistent with this logic. Conroy-Krutz (2013) shows that in Uganda, voters rely heavily on ethnic cues in low-information settings, but ethnic voting declines significantly when quality-relevant information is made available, implying that information-poor campaign environments, precisely those produced by cross-talk, sustain identity-based voting. Conversely, Banerjee et al. (2010) find that in India, while ethnic preferences respond to politician quality in vignette experiments, priming voters in the field on the relevance of corruption left actual electoral outcomes unaffected. Together, these findings suggest that identity rhetoric suppresses the electoral salience of quality information by degrading the information environment.

Our analysis makes three contributions. *First*, we introduce identity rhetoric as an information-jamming device in electoral competition, providing a channel through which identity operates that is distinct from the preference-based models of Akerlof and Kranton (2000) and Shayo (2009) and the social-identity and mobilization frameworks of Dickson and Scheve (2006) and Bassi et al. (2011). *Second*, we establish that identity politics exhibits strategic substitutability through the cross-talk mechanism, offering a rational-choice foundation for the empirical observation that minorities often respond to majoritarian identity politics with programmatic appeals rather than competing identity claims. *Third*, we characterize the welfare costs of identity-based campaigning, showing that majoritarian bias in candidate selection arises endogenously through information suppression, and that improving campaign informativeness can worsen welfare through equilibrium responses, paralleling the logic of Prat (2005) in the domain of campaign rhetoric.

The remainder of the paper proceeds as follows. Section 2 sets out the model. Section 3 establishes the equilibrium, derives the strategic-substitutability property of the reaction functions, and presents comparative statics with respect to demographic composition and campaign informativeness. Section 4 develops the welfare analysis. Section 5 concludes. Proofs are in the Appendix. Appendix A establishes that the best-response existence and uniqueness results extend to general prior distributions satisfying standard regularity conditions.

2 Model

Consider a society with a unit mass of voters that are divided into two identity groups, A and B. Group A has a population proportion $\beta_A = \beta > \frac{1}{2}$ and group B has a size $\beta_B = 1 - \beta$. Hence, group A is the majority group and group B is a minority group. Voters are the same, except for their differences in the identity dimension.

There are two candidates, also named A and B, who represent groups A and B, respectively. Candidates differ on the quality dimension. We denote the quality of candidate $j \in \{A, B\}$ by q_j. Candidate quality q_j captures competence or policy implementation ability, which determines the policy utility voters receive if candidate j holds office. We assume that before the election, a candidate's quality is a piece of private information known only to her. Both candidates and all voters share a common prior: qualities q_A and q_B are independently drawn from the uniform distribution on $[0, 1]$.

Our analysis focuses on the choice of campaign theme by the candidates. A candidate's choice is to either emphasize identity or to reveal information about her quality, i.e., her own policies and programs. We denote the chosen theme of candidate j by σ_j, which takes the value 1 if the candidate employs identity focus and 0 if she employs programmatic focus.

2.1 Voter utilities

Consider an individual voter in group $i \in \{A, B\}$ and her payoff from candidate $j \in \{A, B\}$. We shall refer to candidate j as an ingroup candidate if $i = j$ and as an outgroup candidate if $i \neq j$. The payoff has a non-random and a random component. The non-random component of the payoff of each individual in group i from candidate j is given by

$$V_j(i) = \begin{cases} q_j + a\sigma_j, & \text{if } i = j \\ q_j - b\sigma_j, & \text{if } i \neq j \end{cases} \tag{2.1}$$

where $a > b \geq 0$.

The first component of the payoff from candidate j is the policy utility which depends on the quality q_j of the candidate. We simply take the policy utility to be equal to the candidate quality. We assume that all voters get the same policy utility from a given candidate.

The second component is the identity utility that depends on the candidate's campaign strategy and the identity match between voter i and candidate j. If the ingroup candidate focuses on identity, then there is an additional utility gain of $a > 0$ from one's own identity being promoted. On the other hand, if the outgroup candidate focuses on identity, then the voter gets a disutility of $b > 0$ due to the rival identity being promoted. This follows a literature on psychological payoffs from identity (Akerlof and Kranton, 2000, Shayo, 2009, Bassi et al., 2011, Jenke and Huettel, 2020). Notice that this is a per-voter utility shock, which ensures that the total utility benefit from identity politics is larger for the majority candidate A than for the minority candidate B.

An alternative way to justify the above utility structure is the following: each individual is, with probability s, a "policy type" and with the remaining probability an "identity type". A policy type only cares about the quality of the winning candidate, while an identity type cares only about whether an identity campaign is undertaken and by which candidate. The identity type gets a payoff of a' if the ingroup candidate engages in identity campaign and a payoff of $-b'$ if the outgroup candidate engages in identity campaign. Then the non-random utility of a voter in group i from a candidate in group j is given by

$$\tilde{V_j}(i) = \begin{cases} sq_j + (1-s)a'\sigma_j, & \text{if } i = j \\ sq_j - (1-s)b'\sigma_j, & \text{if } i \neq j \end{cases}$$

Now, by setting $a = \frac{1-s}{s}a'$ and $b = \frac{1-s}{s}b'$ we get $\tilde{V_j}(i) = sV_j(i)$. Since this utility function is only a scale shift of our original utility function, all our results hold with this alternative specification.

In addition to the non-random component, there is an idiosyncratic shock and a common shock. We normalize the idiosyncratic shock for candidate B to 0 and assume that each voter's utility from candidate A has an additive term ε which is drawn from a uniform distribution over $\left[-\frac{1}{2\phi}, \frac{1}{2\phi}\right]$. Finally, there is a "common shock" δ for which the realized value is the same for every individual, and is considered the valence term. This is again a net utility in favor of A and drawn from a uniform distribution over $\left[-\frac{1}{2\psi}, \frac{1}{2\psi}\right]$. Given a realization of ε and δ, a voter in group $i \in \{A, B\}$ compares $V_A(i) + \varepsilon + \delta$ with $V_B(i)$ in order to decide whether to vote for candidate A or B.

In order to ensure that both individual vote probabilities and candidate win probabilities are interior for all values of candidate quality and strategies, we need sufficiently large uncertainty both for the idiosyncratic shock and the common shock. Therefore, we assume that the parameters ϕ and ψ are sufficiently small i.e., $\psi < \frac{1}{2(1+D_A)}$ and $\phi < \frac{1}{2(1+a+b)+\frac{1}{\psi}}$. Where we denote the net identity utility created in the society when candidate $j \in \{A, B\}$ engages in identity politics by $D_j = a\beta_J - b\beta_{-J}$.

We now make two assumptions on the parameters of the model (β, a, b) in order to ensure that the model delivers non-trivial strategic incentives.

Assumption 1. ***(Moderate Majority)*** *The population share of the majority must satisfy* $\frac{1}{2} < \beta < \frac{a}{a+b}$*, which implies that* $D_B > 0$.

Assumption 1 ensures that even the minority candidate derives a strictly positive electoral return from identity politics. Since $D_A - D_B = (a+b)(2\beta - 1) > 0$ whenever $\beta > 1/2$, the majority candidate always benefits more. Together, the assumption guarantees $0 < D_B < D_A$, so both candidates face a genuine tradeoff between exploiting identity and revealing quality. Equivalently, the majority is moderate enough that backlash does not overpower the vote gain when the minority candidate uses identity appeals.

Assumption 2. ***(Limited Net Identity Benefit)*** *The identity utility and the backlash parameter must satisfy* $a - b < \frac{1}{2}$*, which, together with Assumption 1, implies that* $D_A < \frac{1}{2}$.

This assumption limits the *net* identity benefit of both candidates, in particular, the majority candidate. It says that if the benefit to the ingroup candidate engaging in identity politics is high, then the backlash parameter must also be high; and if the backlash is low, then the ingroup identity benefit cannot be very high either. In the absence of this assumption, the majority candidate will always engage in identity politics irrespective of her quality.

The above two assumptions taken together ensure that $0 < D_B < D_A < \frac{1}{2}$, i.e., while identity politics gives both candidates a net positive benefit, the benefit cannot be so high that it swamps the incentive of a very high-quality type to reveal information about their quality. Both are needed for the existence of an interior equilibrium.

2.2 Information Revelation

The choice of campaign theme impacts the identity utility of the voters and the information revealed about candidate quality, which is an important input for the voting decision. If a candidate chooses the identity campaign, then no information is revealed about her quality. On the other hand, when a candidate chooses the programmatic plank as the campaign theme, the amount of information revealed depends on the rival's choice. If both candidates choose to focus on their respective policies, then there is a *fruitful debate* about policies and issue positions, and we assume that the voter learns each candidate's quality. On the other hand, if one candidate chooses to focus on her program and the other runs an identity-based campaign, then the debate is not coordinated on any single issue, and we have *cross-talk*. If there is cross-talk, we assume that the quality of the candidate who chose the programmatic plank is revealed to voters with probability $\alpha \in (0, 1)$ and remains unrevealed with probability $1 - \alpha$.

This structure basically assumes that the politicians set the *agenda* for what the media will report: if both candidates focus on quality or programs, then the media finds facts about the respective programs. If both run identity campaigns, then the media also talks about identity, and no information about quality is revealed. If, on the other hand, one candidate tries to center the discussion on her program and the other on identity, the agenda of the media is divided, and so is the public's attention. In this situation, partial information about the relevant quality is provided. A more *fact-focused* media in our model is one that induces a higher α, i.e., finds facts about a candidate's quality despite the other candidate trying to center the public discussion on identity. We make an important implied restriction here, that there is no "negative campaigning", i.e., a candidate can talk only about his own quality and not that of the rival.

Assumption 3. ***(Sufficient informativeness)*** *If a candidate engages in programmatic politics and the rival engages in identity politics, her quality is revealed with probability α, where $1 > \alpha > \frac{D_A - D_B}{D_A}$.*

This assumption ensures that the topmost quality of the candidate finds it worthwhile to engage in programmatic politics rather than hiding behind identity rhetoric. Economically, this requires that cross-talk is not so weak that programmatic messages are always drowned out whenever the rival plays identity. Equivalently, $D_B > (1 - \alpha)D_A$, which rules out an equilibrium in which the minority candidate campaigns programmatically at every quality level.

2.3 Strategies and beliefs

Our game sequence is simple. Each candidate $j \in \{A, B\}$ simultaneously chooses campaign rhetoric from identity-focused and program-focused. Observing their campaign choices and based on the information revealed or inferred from strategies, voters vote for their preferred candidate. The candidate with the majority of votes wins the election and obtains a win payoff normalized to 1.

Since candidate quality q_j is private information, the strategy of candidate j is a measurable function $\sigma_j : [0,1] \to [0,1]$, where $\sigma_j(q_j)$ is the probability that type q_j chooses identity-focused campaigning. We assume that the prior distribution of quality is uniform over $[0,1]$ for both candidates.

Notice that given a strategy profile (σ_A, σ_B), the same information about quality is revealed to all voters, and therefore, all voters will have the same beliefs. Given these beliefs, denote the pair of expected qualities for the respective candidates as the pair $(\hat{q}_A, \hat{q}_B)$. Notice that when the quality of candidate j is revealed, $\hat{q}_j = q_j$.

Finally, we assume that each voter behaves "sincerely" in the sense of Austen-Smith and Banks (1996). In other words, each voter votes for the candidate yielding a higher expected utility based on the beliefs formed about the quality that gives the equilibrium strategies of the candidates.

3 Analysis

In our model, candidate payoffs are simply win probabilities of each candidates since we have normalized the rent from office to 1. We start by analyzing how win probabilities are determined.

Recall that a voter in group i prefers candidate B if $V_A(i) + \varepsilon + \delta < V_B(i)$. Thus, given a realized value of δ, the probability that a voter in group i votes for B if

$$Pr\big(\varepsilon < (EV_B(i) - EV_A(i)) - \delta\big) = \frac{1}{2} + \phi\big(EV_B(i) - EV_A(i)) - \delta\big), \tag{3.1}$$

where $EV_j(i)$ replaces q_j in $V_j(i)$ with its expected value $\hat{q}_j$.

Therefore, the vote share for candidate B as a function of δ is

$$\begin{aligned} &= \frac{1}{2} + \phi \sum_{i \in \{A,B\}} \beta_i \big(EV_B(i) - EV_A(i) - \delta\big) \\ &= \frac{1}{2} + \phi\big((\hat{q}_B - \hat{q}_A) + \sigma_B D_B - \sigma_A D_A - \delta\big) \end{aligned}$$

Candidate B wins if the vote share exceeds $\frac{1}{2}$, i.e., if $\delta < (\hat{q}_B - \hat{q}_A) + \sigma_B D_B - \sigma_A D_A$. Since $\delta \sim U[-\frac{1}{2\psi}, \frac{1}{2\psi}]$, the win probability is

$$\Pr(B \text{ wins}) = \frac{1}{2} + \psi\big((\hat{q}_B - \hat{q}_A) + \sigma_B D_B - \sigma_A D_A\big). \tag{3.2}$$

Candidate B aims to maximize, and candidate A aims to minimize the above probability.

By linearity, there is no loss in dropping $\frac{1}{2}$ and ψ and considering as the objective only the function

$$(\hat{q}_B - \hat{q}_A) + \sigma_B D_B - \sigma_A D_A \tag{3.3}$$

Note that the pair $(\hat{q}_B, \hat{q}_A)$ is based on information revealed to the voters, which depends stochastically on the strategy profile.

To define the payoff functions formally, let the strategy profile be (σ_A, σ_B). The expected payoff of type q of candidate B from the programmatic campaign (revealing quality information) and identity campaign (concealing information), denoted respectively as $\Pi^B_R(q)$ and Π^B_{NR}, are given by:

$$\begin{aligned}
\Pi^B_R(q)\mid_{\sigma_A,\sigma_B} &= \int_{q_A:\sigma_A(q_A)=1} \big[\alpha q + (1-\alpha)E(q_B|\sigma_B(q_B)=0) - E(q_A|\sigma_A(q_A)=1) - D_A\big]\, dF(q_A) \\
&\quad + \int_{q_A:\sigma_A(q_A)=0} (q - q_A)\, dF(q_A) \qquad (3.4) \\
\Pi^B_{NR}\mid_{\sigma_A,\sigma_B} &= \int_{q_A:\sigma_A(q_A)=1} \big[E(q_B|\sigma_B(q_B)=1) - E(q_A|\sigma_A(q_A)=1) - (D_A - D_B)\big]\, dF(q_A) \\
&\quad + \int_{q_A:\sigma_A(q_A)=0} \big[E(q_B|\sigma_B(q_B)=1) - (\alpha q_A + (1-\alpha)E(q_A|\sigma_A(q_A)=0)) + D_B\big]\, dF(q_A) \\
&\qquad (3.5)
\end{aligned}$$

In $\Pi^B_R(q)$, the first integral is taken over types of candidate A who choose the identity campaign. B's true quality is revealed with probability α, and with the remaining probability, the electorate uses the pooling mean $\hat{q}_B = E(q_B|\sigma_B = 0)$. The second integral corresponds to types of A where A chooses programmatic politics and the quality of both candidates is revealed with certainty. In Π^B_{NR}, the first integral is taken over types of candidate A that use identity campaign, and the second integral is the case where A uses a programmatic campaign. When candidate B uses a programmatic campaign, his quality is inferred as the pooling mean $\hat{q}_B = E(q_B|\sigma_B = 0)$.

The strategy σ_B is a best response to σ_A if,

(i) for all q_B such that $\sigma_B(q_B) = 1$, $\Pi^B_R(q)\mid_{\sigma_A,\sigma_B} \leq \Pi^B_{NR}\mid_{\sigma_A,\sigma_B}$,

(ii) for all q_B such that $\sigma_B(q_B) = 0$, $\Pi^B_R(q)\mid_{\sigma_A,\sigma_B} \geq \Pi^B_{NR}\mid_{\sigma_A,\sigma_B}$, and

(iii) for all q_B such that $\sigma_B(q_B) \in (0,1)$, $\Pi^B_R(q)\mid_{\sigma_A,\sigma_B} = \Pi^B_{NR}\mid_{\sigma_A,\sigma_B}$.

In a Nash equilibrium, σ_j is a best response to σ_{-j}, for $j \in \{A, B\}$. We begin by establishing that equilibrium strategies must be threshold type, i.e., for each candidate j there is a threshold r_j such that she employs an identity campaign if her quality is below the threshold and a programmatic campaign if her quality is above the threshold. We assume that the candidate engages in a programmatic campaign if he is indifferent, but the assumption is immaterial, as indifference is a zero-probability event.

Lemma 3.1. *For each $j \in \{A, B\}$, every equilibrium strategy of candidate j takes a cutoff form: there exists a threshold $r_j \in [0,1]$ such that $\sigma_j(q) = 1$ if $q < r_j$ and $\sigma_j(q) = 0$ if $q \geq r_j$.*

Proof. The proof follows from the observation that, for any strategy profile, a candidate's expected payoff from identity campaign is independent of q (equation (3.5)) while the expected payoff from programmatic campaign is strictly increasing in q. Therefore, any best response strategy must be of a threshold type. □

Given that both candidates follow cut-off strategies, the expected quality of candidate j following non-revelation of quality is denoted by:

(1) $E(q_j|\sigma_j = 1) = E(q_j|q_j < r_j) \equiv \underline{e}_j$

(2) $E(q_j|\sigma_j = 0) = E(q_j|q_j \geq r_j) \equiv \overline{e}_j$

We have already seen that engaging in identity politics provides a positive payoff boost of D_j to candidate j, but this is balanced against a possible cost due to non-revelation of information about quality. If an agent is seen to engage in identity politics, the voter ascribes quality $\underline{e}_j$ to the candidate. This is beneficial for types below $\underline{e}_j$, who are "pooled-up" and costly for types above $\underline{e}_j$, who are "pooled down". It is clear then that above a cutoff quality r_j, candidate j finds it more beneficial to engage in programmatic politics.

However, information revelation through programmatic politics is itself imperfect and depends on the rival's campaign strategy. In particular, if the rival engages in identity politics, there is a probability $1 - \alpha$ with which no information is revealed. But observing the campaign choice, the voters ascribe to the candidate the average quality $\overline{e}_j$. This event is beneficial for types with quality in the range $(r_j, \overline{e}_j)$ but not so for the types in the range $(\overline{e}_j, 1)$. In fact, if the revelation probability α conditional on this event is low enough, programmatic politics is not very attractive for the top types as they are pooled *down* with a large probability.

3.1 Equilibrium characterization

In order to find reaction functions, we fix an arbitrary cutoff r_A for candidate A and characterize the best response of candidate B as a function of realized quality $q_B = q$. While we present our final results with a uniform distribution of quality, at this point, we consider an arbitrary, commonly known distribution F.

We rewrite equations (3.4) and (3.5) where we express the payoffs from the two actions of candidate B in terms of cut-off strategies (r_A, r_B)

$$
\begin{aligned}
\Pi_R^B(q)\mid_{r_A} &= \int_0^{r_A} [\alpha(q-\underline{e}_A)+(1-\alpha)(\overline{e}_B-\underline{e}_A)-D_A]\; dF(q_A) + \int_{r_A}^1 (q-q_A)\, dF(q_A) \\
\Pi_{NR}^B\mid_{r_A} &= \int_0^{r_A} [(\underline{e}_B-\underline{e}_A)-(D_A-D_B)]\; dF(q_A) \\
&\quad + \int_{r_A}^1 [\alpha(\underline{e}_B-q_A)+(1-\alpha)(\underline{e}_B-\overline{e}_A)+D_B]\; dF(q_A)
\end{aligned} \tag{3.6}
$$

The best response to r_A is that threshold of q for which $\Pi_R^B(q) = \Pi_{NR}^B$. Notice that the two functions $\Pi_R^B(q)$ and Π_{NR}^B themselves depend on the cut-offs through $\underline{e}_j$ and $\overline{e}_j$, therefore the threshold may not be unique.

The expected payoff difference between programmatic campaign and identity campaign for a given type q of candidate B following a strategy r_B as a response to a strategy r_A of candidate A, is given by $\Delta(q|r_A, r_B) - D_B$, where

$$
\Delta(q|r_A, r_B) \equiv \{\big(\alpha q + (1-\alpha)\,\overline{e}_B(r_B)\big)F(r_A) + q(1-F(r_A))\} - \underline{e}_B(r_B) \tag{3.7}
$$

Here, $\Delta(q|r_A, r_B)$ is the change in $\hat{q}_B$, i.e., inferred or revealed quality: the term in curly brackets is the expected value of $\hat{q}_B$ if B engages in programmatic politics, and $\underline{e}_B$ is the expected value if B engages in identity politics. Finally, the identity benefit D_B has to be subtracted from $\Delta(q|r_A, r_B)$ to obtain the net change in expected payoff.

Notice that if we set $\alpha = 1$, then $\Delta(q|r_A, r_B)$ reduces to $q - \underline{e}_B$, independent of r_A. In that case, we will still get an optimal cutoff for B, but it will be independent of the strategy r_A. Essentially, our problem will be reduced to a decision-theoretic one for each candidate.

At the best response cutoff r, type $q = r$ of candidate B must be indifferent between the two actions when the candidate himself is using a cutoff $r_B = r$, i.e., we must have $\Delta(r|r_A, r) = D_B$. To find the best response strategy, we denote $\Delta(r|r_A, r)$ as $H(r)$, suppressing the dependence on r_A.

$$
\begin{aligned}
H(r) &\equiv \big(\alpha r + (1-\alpha)\,\overline{e}_B(r)\big)F(r_A) + r(1-F(r_A)) - \underline{e}_B(r) && (3.8)\\
&= [r - \underline{e}_B(r)] + (1-\alpha)F(r_A)[\overline{e}_B(r) - r] && (3.9)
\end{aligned}
$$

As equation (3.9) shows, for the marginal type r, the net return to the programmatic plank has two parts: the avoided pool-down penalty $r - \underline{e}_B(r)$, and, in the event of cross-talk without revelation, which has probability $(1-\alpha)F(r_A)$, the pool-up bonus $\overline{e}_B(r) - r$.

For a unique interior best-response cutoff r_B to exist for any given rival strategy r_A, it suffices that $H(r)$ be strictly increasing and D_B is within the range $(H(0), H(1))$.

However, since both $\overline{e}_B(r)$ and $\underline{e}_B(r)$ increase in r, we cannot guarantee monotonicity of $H(r)$ for a generic distribution F. The following lemma provides a sufficient condition on F for strict monotonicity of $H(r)$ irrespective of the cut-off r_A.

Lemma 3.2. *Suppose F admits a continuous, strictly positive density f on $(0,1)$ with unconditional mean μ. Let F satisfy the following conditions $\forall r \in (0,1)$:*

(i) $\frac{d}{dr}\overline{e}_B(r) \geq \frac{d}{dr}\underline{e}_B(r)$

(ii) $\frac{d}{dr}\underline{e}_B(r) < 1$

These conditions are satisfied for any F that is weakly concave, including the uniform distribution. In addition, provided $(1-\alpha)\mu < D_B < 1-\mu$, there exists a unique interior best response cut-off strategy $r_B^*(r_A) \in (0,1)$ for any given rival strategy $r_A \in [0,1]$.

Proof. In Appendix A.1 □

Recall that according to (3.9), net benefit of programmatic campaign is the combination of avoided pool-down penalty and contingent pool-up bonus. Condition (ii) is equivalent to the pool down penalty being increasing, or that $\int_0^r F(t)dt$ is log-concave. However, the pool-up bonus may be decreasing in r. Condition (i) says that the upper pool average increases faster than the lower pool average, and togethter with condition (ii) ensures that the sum of the pool-up bonus and the pool-down penalty is increasing. This also ensures that their convex combination is increasing for any α and any $F(r_A)$.

Conditions (i) and (ii) hold jointly whenever the pdf is nonincreasing in quality or CDF is weakly concave. While concave F is strictly not necessary for conditions (i) and (ii) to hold, in the appendix we show that for the Beta family of distributions concavity characterises the two conditions jointly.[4] An extreme case is the uniform distribution, where we have $\overline{e}_B(r) = \frac{1+r}{2}$ and $\underline{e}_B(r) = \frac{r}{2}$, implying that both increase at the same rate.

While a concave F guarantees monotonicity of $H(r)$, we also need that the identity boost D_B to be not too high or too low for the best response to be interior. This condition can also be seen as a lower bound on α, the probability of revelation of quality in the programmatic campaign. If α is too high or too low, we can get a corner best response to some rival cutoff.

Proposition 3.1. ***(Equilibrium Existence and Strategic Substitutability under a General Prior)*** *Let F satisfy the conditions of Lemma 3.2 and let $(1-\alpha)\mu < D_B < D_A < 1-\mu$. Then:*

(a) an interior equilibrium $(r_A^*, r_B^*) \in (0,1)^2$ exists;

[4] Formally, within the Beta(c,d) family, condition (i) is equivalent to $c \leq 1 \leq d$, which is exactly the set of parameters at which the density is nonincreasing, and condition (ii), which is itself equivalent to $d \geq 1$, is already implied by condition (i). Proof is in Appendix A.

(b) Candidate B's best response is a strictly decreasing function of the rival cutoff, with

$$\frac{d\tilde{r}_B}{dr_A} = -\frac{(1-\alpha)\, f(r_A)\big[\overline{e}_B(\tilde{r}_B) - \tilde{r}_B\big]}{H'(\tilde{r}_B)} \;<\; 0, \tag{3.10}$$

and the same holds for candidate A. Hence the cutoffs are strategic substitutes.

Proof. In Appendix B.1 □

The above proposition establishes existence of equilibrium and strategic substitutability at the same time. An increase in r_A increases the likelihood of candidate A engaging in identity campaign, which raises the net benefit of programmatic campaign for the cut-off type type r since the event of non-revelation and consequent pool-up bonus happens more frequently. The numerator of (3.10) is the payoff gain at the margin for B, given formally by the pool-up bonus $\overline{e}_B(r) - r$, weighted by the probability $(1-\alpha)$ that cross-talk suppresses revelation and by the density $f(r_A)$ of rival types newly switched into identity campaigning. Since the net benefit of programmatic campaign is increasing in the cut-off $(H'(r) > 0)$, the indifference threshold for B shifts down in response to an increase in r_A.

While a concave prior establishes well-defined and falling reaction functions, does not give us uniqueness: two strictly decreasing reaction curves can cross more than once. The additional condition we need for uniqueness is that the absolute value of the slope of the reaction function is less than unity.[5] It can be checked that if the prior is uniform, this condition holds everywhere. The remainder of the analysis assumes a uniform prior to isolate the strategic mechanisms without sacrificing tractability. So far, we have not used assumptions 1 through 3 made earlier. We now use them in conjunction with the uniform prior.

Note that the bound on α in Lemma 3.2 is set up to ensure the existence of an interior best response for any cut-off strategy of the rival. For uniform priors, this would give us $\alpha > 1 - 2D_B$. However, we only need to restrict informativeness for the rival cut-offs that can arise in equilibrium, which allows us to relax the bound to $\alpha > 1 - \frac{D_B}{D_A}$, as we do in Assumption 3. Moreover, $D_A < 1 - \mu$ reduces to $D_A < \frac{1}{2}$ for uniform prior which is Assumption 2.

Under uniform F, we provide the closed-form reaction functions as Lemma 3.3.

[5] A sufficient condition for uniqueness is that the Jacobian at any solution of $(H(r_A), H(r_B)) = (D_A, D_B)$ be strictly positive, which is equivalent to the product of the slopes to be less than unity.

Lemma 3.3. *Under Assumptions 1–3 and the uniform prior, the reaction functions are*

$$\tilde{r}_A(r_B) = 1 - \frac{1-2D_A}{1-r_B(1-\alpha)},$$
$$\tilde{r}_B(r_A) = 1 - \frac{1-2D_B}{1-r_A(1-\alpha)}.$$

Proof. In Appendix B.2 □

Notice that the reaction functions are strategic substitutes. Also note that if $\alpha = 1$, there will be no strategic interdependence between the two candidates. The following figure shows the reaction functions, and a unique equilibrium is guaranteed by the fact that the slope of both reaction functions is less than unity.

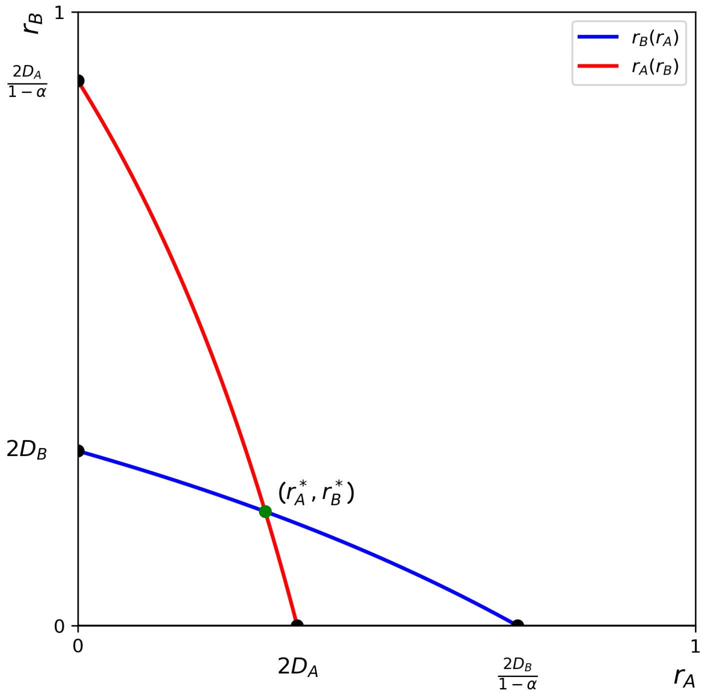

Figure 1: Reaction functions of the two candidates

We formally present our equilibrium result in the next proposition.

Proposition 3.2. *Under Assumptions 1–3 and the uniform prior, there exists a unique interior equilibrium* $(r_A^*, r_B^*) \in (0,1)^2$.

Proof. In Appendix B.3 □

The interiority of the equilibrium cut-offs is an artifact of assumptions 1-3. In absence of these assumptions, under uniform distribution, we still have unique equilibrium but we may have corner solutions[6]. Having established this unique equilibrium, we now turn

[6]Results are available with the authors.

to the structure and comparative statics of these thresholds. While interpreting these results, it is useful to bear in mind that the equilibrium cut-offs identified in Proposition 3.2 also give us the ex-ante probability that the respective candidate will engage in identity politics.

Proposition 3.3 demonstrates that the majority candidate always sets a higher cutoff, thereby relying on identity more often than the minority. This comparative asymmetry in equilibrium strategies is central to our account of how majoritarianism biases campaign rhetoric.

Proposition 3.3. *Under Assumptions 1–3 and the uniform prior, in the equilibrium, the candidate belonging to the majority group has a higher propensity to engage in identity politics, that is* $r_B^* < r_A^*$.

Proof. In Appendix B.4 □

The above result follows directly from the population asymmetry in favor of candidate A, creating an advantage in identity politics. Mathematically speaking, since $D_A > D_B$, the intersection of the two reaction functions lies below the 45° line in Figure 1. This result shows that identity politics has a systematic majoritarian bias. Even if the two candidates are ex ante drawn from the same quality distribution, the equilibrium pattern of rhetoric ensures that the majority candidate is more likely to cloak herself in identity politics. Consequently, voters are more likely to have less information about the majority candidate's quality than the minority's, increasing the chances that a lower-quality majority candidate is elected. We formally discuss majoritarian bias in candidate selection in Section 4.2.

Next, we examine how the equilibrium thresholds respond to changes in the underlying primitives of the model. These comparative statics reveal how demographic and institutional parameters shape the strategic environment: as group size, identity push, or the informativeness of campaigns shift, the incentives to engage or disengage identity politics adjust in expected ways.

3.2 Comparative Statics

Proposition 3.4. *Under Assumptions 1–3 and the uniform prior, as the population share of the majority group rises, the majority candidate's propensity to engage in identity politics rises. Conversely, the minority candidate's propensity to engage in identity politics decreases, i.e.,* $\frac{dr_A^*}{d\beta} > 0$ *and* $\frac{dr_B^*}{d\beta} < 0$.

Proof. In Appendix B.5 □

The intuition behind this is as follows: as the size of the majority rises, the identity bump for the majority D_A increases and the identity bump for the minority D_B decreases.

The direct effect is therefore an increase in identity politics for the majority and a decrease in identity politics for the minority. However, due to strategic substitutability, an increase in the majority candidate's cutoff pushes down the minority cut-off further; and similarly, an reduction in minority cut-off raises the majority cut-off further.

Thus, in this model, majoritarianism is a self-enforcing spiral. A larger majority raises the asymmetry in identity benefit between the majority and minority through the direct effect, inducing the majority candidate to increase identity focus and the minority candidate to increase the programmatic focus. But this paper points out a subtler reinforcing effect: as the majority candidate engages in identity politics more frequently, programmatic campaign becomes less revealing, allowing the moderate types of the minority candidate to pool with "better" types more frequently using programmatic campaign. On the other hand, as the minority candidate engages in more programmatic campaign, the moderate types of the majority candidate have reduced benefit of "pooling up" and therefore engage in identity campaign more frequently.

Proposition 3.4 links demographic structure to the endogenous supply of information in elections. As the majority grows, the majority candidate hides behind identity more often, and consequently, voters face less information about their competence. This makes electoral mistakes more likely, systematically favoring the majority candidate (see Section 4.2 for formal discussion). This result also aligns with the empirical evidence showing that larger ethnic groups are more likely to engage in identity politics (Posner, 2005, Chandra, 2005, 2007, Eifert et al., 2010).

Recall that if a candidate engages in identity campaign, each member of his ingroup gains an identity utility a and each member of the rival group earns a disutility b. The following proposition tells us how the equilibrium cutoffs change due to identity push a and pushback b.

Proposition 3.5. *Under Assumptions 1–3 and uniform prior:*

(i) An increase in the identity push a raises both equilibrium cutoffs, and the increase is strictly larger for the majority candidate: $\frac{dr_A^*}{da} > \frac{dr_B^*}{da} > 0$.

(ii) An increase in the backlash b lowers both equilibrium cutoffs, and the decrease is strictly larger for the minority candidate: $\frac{dr_B^*}{db} < \frac{dr_A^*}{db} < 0$.

Proof. In Appendix B.6 □

The identity push a raises both cutoffs because it increases D_j for both candidates (D_A by β and D_B by $1-\beta$). The increase is larger for the majority candidate because $\partial D_A/\partial a = \beta > 1-\beta = \partial D_B/\partial a$, and the strategic interaction amplifies this initial asymmetry. Symmetrically, a higher backlash b reduces both cutoffs but affects the minority candidate more, since $|\partial D_B/\partial b| = \beta > 1-\beta = |\partial D_A/\partial b|$.

Strong identity attachments create fertile ground for identity politics; conversely, when backlash is strong, for instance, when civil society or institutions impose costs on exclusionary rhetoric, identity politics becomes less sustainable. This logic parallels findings that ethnic and partisan identity primes crowd out policy evaluation (Bassi et al., 2011), while institutional or societal backlash can discipline politicians (Kitschelt and Wilkinson, 2007).

The preceding analysis assumes symmetric ingroup identity benefit a and the outgroup backlash b across groups. While this economizes on parameters, the symmetry is in no way necessary. In fact, for a given group J, we could define a_j as the extra utility a member receives when the ingroup member engages in identity politics and b_j as the extra reduction in utility for a member when the outgroup candidate engages in identity politics. Then we can redefine $D_j = \beta_J a_j - \beta_{-J} b_{-j}$. As long as assumptions 1–3 made on the identity parameters of both groups, our entire analysis will go through. Now, we may have D_A increasing without D_B decreasing, and vice versa. This generalization accommodates scenarios like identity consolidation by one group, possibly due to the arrival of a strong leader. This would imply a (and possibly, but not necessarily b) growing for only one group. Our results will continue to hold through the separate effects on D_A and D_B.

Proposition 3.6. *Under Assumptions 1–3 and the uniform prior:*

(i) The minority candidate's equilibrium cutoff is strictly increasing in campaign informativeness: $\frac{dr_B^*}{d\alpha} > 0$.

(ii) The majority candidate's equilibrium cutoff satisfies $\frac{dr_A^*}{d\alpha} > 0$ *if and only if* $r_B^* > (1-\alpha)\, r_A^*$, *and* $\frac{dr_A^*}{d\alpha} < 0$ *otherwise.*

(iii) For α *sufficiently close to* 1, *both equilibrium cutoffs are increasing in* α.

Proof. In Appendix B.7 □

The minority candidate always hides more when programmatic campaigns become more informative. Higher α sharpens the revelation risk: if the minority's quality is revealed to be below the rival's, the minority's win probability falls, and he is more likely to lose. This direct effect pushes marginal types into identity rhetoric and is reinforced, for the minority, by the equilibrium response of the rival. For the majority candidate, however, this directly competes with a strategic substitutability channel. When the minority raises its cutoff in response to a higher α, the majority's best response is to lower its cutoff. The condition $r_B^* > (1-\alpha)\, r_A^*$ determines which effect prevails. The quantity $(1-\alpha)\, r_A^*$ measures the unconditional probability that the majority's identity rhetoric suppresses the minority's programmatic message in cross-talk. When this probability exceeds r_B^*, a marginal increase in α substantially reduces information jamming by the majority, triggering a large upward response from the minority. The resulting strategic substitutability effect then dominates the majority's own direct incentive to hide, driving r_A^* down.

This result echoes the logic of Prat (2005), where greater transparency can reduce equilibrium information revelation by distorting agent behavior. In our setting, the channel is the campaign choice itself: a more informative environment paradoxically expands the range of types who conceal quality. Evidence that voters exposed to more information sometimes rely more heavily on identity cues (Conroy-Krutz, 2013, Banerjee et al., 2010) is consistent with this mechanism. Notably, while the effect on individual cutoffs may differ across candidates, the asymmetry between them always shrinks, as the following corollary establishes. In Section 4, we examine whether the increased hiding has welfare consequences and show that the net effect of higher α on voter welfare is ambiguous.

Corollary 3.1. *At any interior equilibrium under Assumptions 1–3 and the uniform prior, the asymmetry in identity politics between the majority and minority candidates satisfies*

$$r_A^* - r_B^* = \frac{2(D_A - D_B)}{\alpha}, \tag{3.11}$$

which is strictly decreasing in α. Higher campaign informativeness always narrows the gap between the two candidates' propensities to engage in identity politics.

Proof of Corollary 3.1. The equilibrium conditions from Lemma 3.3 are

$$(1 - r_A^*)\big[1 - (1 - \alpha)\, r_B^*\big] = 1 - 2D_A, \tag{3.12}$$

$$(1 - r_B^*)\big[1 - (1 - \alpha)\, r_A^*\big] = 1 - 2D_B. \tag{3.13}$$

Expanding both and subtracting (3.12) from (3.13), the cross-terms $(1-\alpha)\, r_A^* r_B^*$ cancel, yielding

$$(r_A^* - r_B^*)\,\alpha = 2(D_A - D_B).$$

Since D_A and D_B do not depend on α, the result follows. □

The equilibrium and comparative statics of Section 3 characterize how candidates choose between identity and programmatic rhetoric. We now turn to the welfare consequences, asking whether and how identity politics deteriorates voters' welfare.

4 Welfare Analysis

4.1 Welfare Framework

Given realized qualities (q_A, q_B) and campaign profile (σ_A, σ_B), aggregate voter welfare when candidate J wins is $q_j + \sigma_j D_j$, obtained by weighting each group's utility by its population share.[7] Ex-ante welfare, integrating over qualities, equilibrium strategies, the revelation outcome, and the common valence shock, decomposes as

$$EW = \mathbb{E}[Q^*] + \mathbb{E}[I^*] \tag{4.1}$$

where $\mathbb{E}[Q^*] = \mathbb{E}[\pi_A q_A + \pi_B q_B]$ is the *selection component*, the expected quality of the elected candidate, and $\mathbb{E}[I^*] = \mathbb{E}[\pi_A \sigma_A(q_A) D_A + \pi_B \sigma_B(q_B) D_B]$ is the *identity component*, the expected aggregate identity payoff delivered through the election. Because $D_j > 0$, identity rhetoric delivers a strictly positive expressive payoff, so the sign of EW relative to the full-information benchmark is ambiguous: identity campaigns can raise total measured utility even as they degrade candidate selection. We therefore evaluate identity politics through $\mathbb{E}[Q^*]$, the criterion of a planner who values governance quality alone. This is the relevant object if the identity payoffs a and b are treated as expressive or psychological returns that a normative criterion need not credit, and it isolates the informational distortion that is the subject of this paper.[8]

Full-information benchmark: The natural benchmark fixes $\sigma_j(q_j) = 0$ for all types, so both candidates always reveal quality ($r_A = r_B = 0$). Under full revelation, the win probability of B reduces to $\pi_B = \frac{1}{2} + \psi(q_B - q_A)$, giving $\pi_A q_A + \pi_B q_B = \frac{q_A+q_B}{2} + \psi(q_A - q_B)^2$. Integrating over independent $q_A, q_B \sim U[0,1]$ yields

$$\mathbb{E}[Q^*]^{FI} = \frac{1}{2} + \frac{\psi}{6} \tag{4.2}$$

The $\frac{\psi}{6}$ term equals $\psi\big[\mathrm{Var}(q_A) + \mathrm{Var}(q_B)\big]$ and captures the electorate's ability to tilt toward the better candidate when qualities diverge, scaled by the responsiveness ψ of the election to expected-utility differentials. We also note for later reference that full-information *selection efficiency*, the probability that the higher-quality candidate wins, equals $SE^{FI} = \frac{1}{2} + \psi\mathbb{E}[|q_A - q_B|] = \frac{1}{2} + \frac{\psi}{3}$.

4.2 The Costs of Identity Politics

We establish three results, each capturing a distinct dimension of welfare loss: identity politics reduces expected quality below the full-information benchmark, lowers the selection efficiency, the probability that the higher-quality candidate wins and generates

[7] Aggregating: $\beta_J(q_j + a\sigma_j) + \beta_{-J}(q_j - b\sigma_j) = q_j + \sigma_j D_j$.

[8] Write $T_B = (\hat{q}_B - \hat{q}_A) + \sigma_B D_B - \sigma_A D_A$, so that $\pi_B = \frac{1}{2} + \psi T_B$. Now, $\hat{q}_j \in [0,1]$, with restriction $\psi < \frac{1}{2(1+D_A)}$ imposed in Section 2 guarantees $\pi_B \in (0,1)$ throughout. Since $\pi_B - \frac{1}{2} = \psi T_B$ and the equilibrium cutoffs depend only on (D_A, D_B, α), the gaps in $\mathbb{E}[Q^*]$, in selection efficiency and in the bias relative to full information are proportional to ψ, so their signs and comparative statics are invariant to ψ, which scales only magnitudes.

selection errors that disproportionately favor the majority candidate.

Proposition 4.1. *Under Assumptions 1–3 and the uniform prior, at any interior equilibrium* $(r_A^*, r_B^*) \in (0,1)^2$ *with* $\alpha < 1$,

$$\mathbb{E}[Q^*] < \mathbb{E}[Q^*]^{FI} = \frac{1}{2} + \frac{\psi}{6}.$$

Proof. In Appendix B.8. □

The proof partitions the quality space $[0,1]^2$ into four rectangles corresponding to the campaign profiles $(\sigma_A, \sigma_B) \in \{0,1\}^2$, computes the expected quality of the winner within each rectangle, and aggregates. The welfare loss $L = \mathbb{E}[Q^*]^{FI} - \mathbb{E}[Q^*]$ admits a clean decomposition into three strictly positive terms:

$$L = \psi \left[\frac{r_A^3 + r_B^3}{12} + \frac{(1-\alpha)\left[r_A(1-r_B)^3 + r_B(1-r_A)^3\right]}{12} + \frac{D_A\, r_A(1-r_A) + D_B\, r_B(1-r_B)}{2} \right] \tag{4.3}$$

The first bracketed term captures the loss from quality being hidden behind identity rhetoric. When candidate J plays identity, voters cannot distinguish among types in $[0, r_j]$ and assign the pooling mean $r_j/2$, forfeiting the selection benefit of observing true quality. The second term reflects the additional information loss under cross-talk; when one candidate plays programmatic, and the rival plays identity, revelation fails with probability $1-\alpha$, and the programmatic candidate is evaluated at the upper pooling mean $\bar{e}_j$ rather than at true quality. As $\alpha \to 1$, this term vanishes. The third term captures the vote distortion from identity benefits: the identity payoff D_j tilts the election toward the identity-playing candidate regardless of quality, generating selection errors in which a low-quality identity candidate defeats a higher-quality rival.

At any interior equilibrium, all three terms are strictly positive and $\psi > 0$. The decomposition makes transparent that even if cross-talk becomes perfectly informative, identity politics continues to reduce welfare through pooling and vote distortion as long as the equilibrium cutoffs remain interior.

Next, we measure how identity politics affects the electorate's ability to select the better candidate. Define *selection efficiency* as the probability that the higher-quality candidate wins:

$$SE := \Pr(\text{higher-quality candidate wins}) = \mathbb{E}\left[\pi_A \mathbf{1}\{q_A > q_B\} + \pi_B \mathbf{1}\{q_B > q_A\}\right]. \tag{4.4}$$

The first-best benchmark is $SE^{FB} = 1$, attained by a planner who observes both qualities. Under full information, the valence shock δ still causes occasional selection errors; as noted in Section 4.1, the full-information benchmark is $SE^{FI} = \frac{1}{2} + \frac{\psi}{3}$.

Proposition 4.2. *Under Assumptions 1–3 and the uniform prior, at any interior equilibrium* $(r_A^*, r_B^*) \in (0,1)^2$ *with* $\alpha \in (0,1)$,

$$SE < SE^{FI} = \tfrac{1}{2} + \tfrac{\psi}{3}.$$

Proof. In Appendix B.9. □

The proof computes selection efficiency case by case over the four rectangles of the quality space, splitting each rectangle along the diagonal $q_A = q_B$. The selection-efficiency loss $\Lambda := SE^{FI} - SE$ decomposes as $\Lambda = \Lambda^D + \Lambda^Q$:

$$\Lambda = \psi\left[D_A\, r_A(1-r_A) + D_B\, r_B(1-r_B) + \frac{r_A^3 + r_B^3}{6} + \frac{(1-\alpha)(r_A - r_B)^2(3 - 2r_A - r_B)}{6}\right] \tag{4.5}$$

The identity based distortion $\Lambda^D = \psi\big[D_A\, r_A(1-r_A) + D_B\, r_B(1-r_B)\big]$ captures the direct effect of identity benefits on vote shares: even when voters correctly infer that an identity-playing candidate is of below-average quality, the payoff D_j can tilt the election in that candidate's favor. The remaining quantity from Λ, the quality information loss $\Lambda^Q = \psi\big[\frac{r_A^3+r_B^3}{6} + \frac{(1-\alpha)(r_A-r_B)^2(3-2r_A-r_B)}{6}\big]$, reflects the impairment of the electorate's ability to distinguish candidates when quality is hidden or imperfectly revealed. Both components are strictly positive at any interior equilibrium, confirming that identity politics degrades selection efficiency below the full-information level.

Finally, we show that the selection errors documented above are not symmetric across candidates: they systematically favor the majority. Define the *majoritarian bias* in candidate selection as

$$\text{Bias} = \Pr(A \text{ wins},\ q_A < q_B) - \Pr(B \text{ wins},\ q_B < q_A). \tag{4.6}$$

Positive bias means that selection mistakes, elections in which the lower-quality candidate wins, occur more frequently in favor of the majority candidate A.

Proposition 4.3. *Under Assumptions 1–3 and the uniform prior, at any interior equilibrium* $(r_A^*, r_B^*) \in (0,1)^2$,

$$\text{Bias} = \psi\big(r_A^*\, D_A - r_B^*\, D_B\big) > 0.$$

Proof. In Appendix B.10. □

The proof rests on a useful identity. Using $\pi_A = 1 - \pi_B$ and the fact that $\mathbf{1}\{q_A < q_B\} + \mathbf{1}\{q_B < q_A\} = 1$, under the uniform prior, the bias reduces to

$$\text{Bias} = \tfrac{1}{2} - \Pr(B \text{ wins}). \tag{4.7}$$

Computing $\Pr(B \text{ wins})$ case by case over the four rectangles of the quality space, the quality-based contributions to B's unconditional win probability cancel exactly, regardless of the cutoff pair (r_A, r_B). What remains are the identity-weighted terms: the coefficient of D_A is $-r_A$ and the coefficient of D_B is $+r_B$, yielding $\Pr(B \text{ wins}) = \frac{1}{2} - \psi(r_A D_A - r_B D_B)$ and hence the stated formula.

The positive bias reflects two forces that reinforce each other. First, the majority candidate hides behind identity more often ($r_A^* > r_B^*$, Proposition 3.3), so the event in which A's quality is concealed behind the pooling mean is more probable. Second, the majority candidate's net identity benefit is larger ($D_A > D_B$), so when A does play identity, the resulting vote-share tilt is stronger than when B does. These forces multiply: $r_A^* D_A > r_B^* D_A > r_B^* D_B$, where the first inequality uses $r_A^* > r_B^*$ and the second uses $D_A > D_B$.

An important theoretical feature of this result is that it emerges entirely from the endogenous suppression of information. Under the full-information benchmark ($r_A = r_B = 0$), the majoritarian bias is exactly zero. Because the probabilistic voting framework evaluates candidates on relative quality and symmetric valence shocks, sheer numerical superiority alone does not generate an electoral advantage in the absence of identity benefits. The bias arises exclusively because the majority candidate is structurally incentivized to weaponize their demographic advantage, hiding their quality behind identity rhetoric more frequently than the minority candidate. Consequently, majoritarian electoral systems do not inherently favor the majority group in selecting high-quality candidates; rather, it is the strategic concealment of quality behind identity rhetoric that manufactures this bias.

4.3 Welfare and Campaign Informativeness

We now examine how the expected quality of the elected candidate responds to changes in cross-talk informativeness α. Using $\mathbb{E}[Q^*] = \frac{1}{2} + \frac{\psi}{6} - L$ from Proposition 4.1, the total derivative decomposes as

$$\frac{d\,\mathbb{E}[Q^*]}{d\alpha} = \underbrace{-\frac{\partial L}{\partial \alpha}\bigg|_{r_A, r_B}}_{\text{direct effect}} + \underbrace{\left(-\frac{\partial L}{\partial r_A}\frac{dr_A^*}{d\alpha} - \frac{\partial L}{\partial r_B}\frac{dr_B^*}{d\alpha}\right)}_{\text{indirect effect}}. \tag{4.8}$$

The direct effect, evaluated at fixed cutoffs, is

$$-\frac{\partial L}{\partial \alpha}\bigg|_{r_A, r_B} = \psi\,\frac{r_A(1-r_B)^3 + r_B(1-r_A)^3}{12} > 0$$

Higher informativeness improves quality revelation in cross-talk, reducing the welfare loss mechanically. To sign the indirect effect, we must determine $\partial L / \partial r_j$ at equilibrium.

Lemma 4.1. *Under Assumptions 1–3 and the uniform prior, at any interior equilibrium* $(r_A^*, r_B^*) \in (0,1)^2$ *with* $\alpha \in (0,1)$,

$$\frac{\partial L}{\partial r_A}\bigg|_{eq} = \psi \left[\frac{r_A(1-r_A)\big[1-(1-\alpha)r_B\big]}{4} + \frac{(1-\alpha)(1-r_B)^3}{12} \right] > 0,$$

$$\frac{\partial L}{\partial r_B}\bigg|_{eq} = \psi \left[\frac{r_B(1-r_B)\big[1-(1-\alpha)r_A\big]}{4} + \frac{(1-\alpha)(1-r_A)^3}{12} \right] > 0.$$

A marginal increase in either equilibrium cutoff strictly increases the welfare loss.

Proof. In Appendix B.11. □

Proposition 4.4. *Under Assumptions 1–3 and the uniform prior, at any interior equilibrium* $(r_A^*, r_B^*) \in (0,1)^2$ *with* $\alpha \in (0,1)$:

(i) The direct effect of increasing α *on* $\mathbb{E}[Q^*]$ *is strictly positive.*

(ii) The indirect effect through r_B^* *is strictly welfare-reducing, since* $\frac{dr_B^*}{d\alpha} > 0$ *(Proposition 3.6) and* $\frac{\partial L}{\partial r_B}\big|_{eq} > 0$ *(Lemma 4.1).*

(iii) The net effect $\frac{d\mathbb{E}[Q^*]}{d\alpha}$ *is ambiguous in sign.*

Proof. Parts (i) and (ii) are established above. For part (iii), the indirect effect through r_A^* has the sign of $\frac{dr_A^*}{d\alpha}$, which by Proposition 3.6(ii) is positive when $r_B^* > (1-\alpha)r_A^*$ and negative otherwise. When $\frac{dr_A^*}{d\alpha} > 0$, both indirect channels oppose the direct effect; when $\frac{dr_A^*}{d\alpha} < 0$, the channels through r_A^* and r_B^* work in opposite directions. In either case, the net sign depends on parameter values. Table 1 provides two numerical examples, reported in units of ψ, confirming that both signs are attainable. □

Table 1: The ambiguous welfare effect of campaign informativeness

	Set 1	**Set 2**
$(\beta,\ a,\ b,\ \alpha)$	(0.635, 0.341, 0.123, 0.913)	(0.511, 0.634, 0.218, 0.820)
$(D_A,\ D_B)$	(0.1716, 0.0464)	(0.2174, 0.1986)
$(r_A^*,\ r_B^*)$	(0.3395, 0.0651)	(0.3966, 0.3509)
Direct effect / ψ	+0.025	+0.015
Indirect effect / ψ	−0.007	−0.026
Net effect $\frac{1}{\psi}\frac{d\mathbb{E}[Q^*]}{d\alpha}$	**+0.018**	**−0.011**

Entries are normalized by ψ. Since $\psi > 0$, the sign of every effect is invariant to the choice of ψ within the admissible range ($\psi < \frac{1}{2(1+D_A)}$).

Greater campaign informativeness improves welfare directly by raising the probability of quality revelation in cross-talk, but also sharpens the revelation risk for intermediate-quality types, inducing a retreat into identity rhetoric. The minority candidate always raises her cutoff in response to a higher α (Proposition 3.6(i)), creating a welfare-reducing indirect channel. The majority candidate may raise or lower her cutoff depending on the parameters. When the strategic substitutability effect dominates ($\frac{dr_A^*}{d\alpha} < 0$), the indirect effect through r_A^* reinforces the direct benefit, yet the net effect can still be negative if the minority's response is sufficiently strong.

5 Conclusion

We study electoral competition in an environment where voters care about both the group identity and the candidate quality. The central mechanism is informational. Identity rhetoric does not just deliver utility to co-group voters; it degrades the quality of public discourse when the rival is trying to campaign on substance. Cross-talk between an identity campaign and a programmatic campaign leaves voters with less information about competence than either campaign alone would suggest. This generates strategic substitutability in identity politics. When the majority candidate leans more into identity rhetoric, the minority's best response is often to shift toward programmatic campaigning rather than to escalate with competing identity appeals.

The consequences for candidate selection are stark. Identity-based campaigning reduces the expected quality of the elected candidate and lowers selection efficiency below what voters would achieve under full information. The resulting electoral mistakes disproportionately favor majority candidates. They benefit more often from information suppression, producing an endogenous majoritarian bias in candidate selection. The bias is attributable to candidates' concealment of quality behind identity rhetoric due to information jamming; under full information, the election is unbiased.

Improving campaign informativeness may not be helpful either. Sharper revelation raises the stakes for intermediate-quality candidates, who now face a higher probability of being exposed at their true, mediocre quality. Some of these candidates retreat into identity rhetoric in response. The minority candidate always increases her reliance on identity when informativeness rises; the majority candidate may do the same. The net effect on voter welfare can go in either direction. Reforms targeting the information environment, whether through media policy, debate formats, or disclosure requirements, cannot be evaluated without taking into account candidates' equilibrium response to those reforms.

Several limitations of the analysis deserve mention. We restrict attention to pure strategies, two candidates, and a common quality distribution. The identity dimension is unidimensional, and group membership is fixed. Relaxing any of these would be a useful extension. A model with multiple identity dimensions or endogenous identity salience could address settings where politicians construct or activate cleavages rather than simply exploit existing ones. Dynamic extensions in which candidates learn about voter responsiveness across campaign stages would connect the framework to the growing empirical literature on campaign dynamics.

A Existence and Uniqueness under General Distributions

Appendix A.1 proves the Lemma 3.2. Proposition A.1 then establishes the claim, made in the statement of the lemma, that conditions (i) and (ii) hold for every weakly concave prior, and Proposition A.2 identifies the exact subset of the Beta family on which they hold.

A.1 Proof of Lemma 3.2

Here, we establish conditions on a general prior distribution F that guarantee a unique interior best-response cutoff $r_B \in (0,1)$ to equation (3.8) for any fixed rival interior cutoff r_A. Let $H(r)$ denote the left-hand side of equation (3.8), which represents the expected net informational return to a programmatic campaign for a marginal type r.

Proof. We first evaluate the boundary limits of $H(r)$. Since $\lim_{r\to 0} \underline{e}_B(r) = 0$, $\lim_{r\to 1} \overline{e}_B(r) = 1$, $\lim_{r\to 0} \overline{e}_B(r) = \mu$, and $\lim_{r\to 1} \underline{e}_B(r) = \mu$, it follows that:

$$\lim_{r\to 0} H(r) = (1-\alpha)\mu F(r_A) \leq (1-\alpha)\mu,$$
$$\lim_{r\to 1} H(r) = 1-\mu.$$

Given the parameter bounds $(1-\alpha)\mu < D_B < 1-\mu$, the Intermediate Value Theorem implies that at least one interior solution $r_B \in (0,1)$ exists.

To establish uniqueness, it suffices to show that $H(r)$ is strictly increasing. Differentiating the conditional expectations yields:

$$\frac{d}{dr}\overline{e}_B(r) = \frac{f(r)}{1-F(r)}\big(\overline{e}_B(r) - r\big), \tag{A.1}$$
$$\frac{d}{dr}\underline{e}_B(r) = \frac{f(r)}{F(r)}\big(r - \underline{e}_B(r)\big). \tag{A.2}$$

Therefore, the derivative of $H(r)$ is:

$$H'(r) = \left(\alpha + (1-\alpha)\frac{d}{dr}\overline{e}_B(r)\right) F(r_A) + (1-F(r_A)) - \frac{d}{dr}\underline{e}_B(r). \tag{A.3}$$

By condition (i), $\frac{d}{dr}\overline{e}_B(r) \geq \frac{d}{dr}\underline{e}_B(r)$, so substituting this into (A.3) yields:

$$\begin{aligned} H'(r) &\geq \left(\alpha + (1-\alpha)\frac{d}{dr}\underline{e}_B(r)\right) F(r_A) + (1 - F(r_A)) - \frac{d}{dr}\underline{e}_B(r) \\ &= \left(1 - \frac{d}{dr}\underline{e}_B(r)\right) \Big[1 - (1-\alpha)F(r_A)\Big]. \end{aligned}$$

Since $\alpha \in (0,1)$ and $F(r_A) \leq 1$, the bracketed term $\big[1-(1-\alpha)F(r_A)\big]$ is strictly positive. By condition (ii), $\frac{d}{dr}\underline{e}_B(r) < 1$, so the first term is also strictly positive. Therefore, $H'(r) > 0$ for all $r \in (0,1)$, implying that the interior solution is unique. □

A.2 Priors with a Nonincreasing Density

Proposition A.1. *Let F admit a continuous, strictly positive density f on $(0,1)$, and suppose f is nonincreasing, equivalently that F is weakly concave. Then conditions (i) and (ii) of Lemma 3.2 hold for all $r \in (0,1)$.*

Proof. **Condition (ii).** Since $\int_0^r t f(t)\, dt = rF(r) - \int_0^r F(t)\, dt$,

$$\underline{e}_B(r) = r - \frac{\int_0^r F(t)\, dt}{F(r)}, \qquad \text{and} \qquad \frac{d}{dr}\underline{e}_B(r) = \frac{f(r)\int_0^r F(t)\, dt}{F(r)^2} \tag{A.4}$$

by (A.2). Since $f > 0$, F is strictly increasing, and therefore $\int_0^r F(t)\, dt < rF(r)$. Since f is nonincreasing, $F(r) = \int_0^r f(t)\, dt \geq rf(r)$. Combining the two,

$$\frac{d}{dr}\underline{e}_B(r) \; < \; \frac{f(r)\, rF(r)}{F(r)^2} \; = \; \frac{rf(r)}{F(r)} \; \leq \; 1.$$

Condition (i). We first convert the comparison of slopes in condition (i) into a comparison of levels. Subtracting (A.2) from (A.1)

$$\frac{d}{dr}\overline{e}_B(r) - \frac{d}{dr}\underline{e}_B(r) = \frac{f(r)}{F(r)\big(1 - F(r)\big)} \Big[F(r)\,\overline{e}_B(r) + \big(1 - F(r)\big)\underline{e}_B(r) - r\Big]. \tag{A.5}$$

Since $F(r)\underline{e}_B(r) + \big(1 - F(r)\big)\overline{e}_B(r) = \mu$, the bracketed term in (A.5) equals $\underline{e}_B(r) + \overline{e}_B(r) - r - \mu$. Since $f > 0$ and $0 < F(r) < 1$ on $(0,1)$, the term outside the bracket is strictly positive, and condition (i) at r is therefore equivalent to the level inequality

$$\underline{e}_B(r) + \overline{e}_B(r) \; \geq \; r + \mu. \tag{A.6}$$

Thus, the two pooling means added together must not fall below the marginal type plus the unconditional mean.

Now we have to establish (A.6) for weakly concave F. Let $p = F(r)$ and substitute

$u = F(t)$ in each conditional mean,

$$\underline{e}_B(r) = \frac{1}{p}\int_0^p F^{-1}(u)\,du, \qquad \overline{e}_B(r) = \frac{1}{1-p}\int_p^1 F^{-1}(u)\,du.$$

Using the law of total expectation to write (A.6) equivalently as $F(r)\overline{e}_B(r) + \big(1 - F(r)\big)\underline{e}_B(r) \geq r$ (or directly using (A.5)), the inequality to be shown is

$$(1-p)\cdot\frac{1}{p}\int_0^p F^{-1}(u)\,du \;+\; p\cdot\frac{1}{1-p}\int_p^1 F^{-1}(u)\,du \;\geq\; F^{-1}(p) = r, \tag{A.7}$$

that is, the average of the two conditional means taken with the weights interchanged is at least the marginal type. Since F is concave and strictly increasing, F^{-1} is convex on $[0,1]$, so it admits a subgradient g at the interior point p:

$$F^{-1}(u) \;\geq\; F^{-1}(p) + g\,(u-p) \qquad \text{for all } u \in [0,1].$$

Averaging this bound separately over $[0,p]$ and over $[p,1]$, and using $\frac{1}{p}\int_0^p (u-p)\,du = -\frac{p}{2}$ and $\frac{1}{1-p}\int_p^1 (u-p)\,du = \frac{1-p}{2}$, we obtain

$$\frac{1}{p}\int_0^p F^{-1}(u)\,du \;\geq\; F^{-1}(p) - g\,\frac{p}{2}, \qquad \frac{1}{1-p}\int_p^1 F^{-1}(u)\,du \;\geq\; F^{-1}(p) + g\,\frac{1-p}{2}.$$

Multiplying the first inequality by $1-p$, the second by p, and adding, the two terms involving g are $-g\,p(1-p)/2$ and $+g\,p(1-p)/2$, which cancel exactly. The LHS of (A.7) is therefore bounded below by $F^{-1}(p) = r$, establishing (A.6) and hence condition (i). $\square$

A.3 The Beta Family

Proposition A.2. *Let F be the Beta(c,d) distribution on $[0,1]$ with parameters $c, d > 0$ and mean $\mu = \frac{c}{c+d}$. Conditions (i) and (ii) of Lemma 3.2 hold for all $r \in (0,1)$ if and only if $c \leq 1 \leq d$, which is exactly the set of parameters at which the Beta density is nonincreasing.*

Proof. **Sufficiency.** The Beta density is $f(r) = r^{c-1}(1-r)^{d-1}/B(c,d)$, where $B(\cdot,\cdot)$ is the Beta function, so that

$$\frac{d}{dr}\log f(r) = \frac{c-1}{r} - \frac{d-1}{1-r}.$$

If $c \leq 1 \leq d$, the first term is nonpositive and the second is nonnegative on all of $(0,1)$, so f is nonincreasing and Proposition A.1 applies. Conversely, if $c > 1$ then $\frac{d}{dr}\log f(r) \to +\infty$ as $r \to 0$, and if $d < 1$ then $\frac{d}{dr}\log f(r) \to +\infty$ as $r \to 1$; in either case f is strictly increasing on some subinterval. Hence $c \leq 1 \leq d$ is precisely the region on which the density is nonincreasing.

Necessity. The complement of $\{c \le 1 \le d\}$ is $\{c > 1\} \cup \{d < 1\}$, so it suffices to exhibit a violation in each of these two cases. We use three endpoint limits. As $r \to 0$ we have $F(r) = \frac{r^c}{c\,B(c,d)}\big(1 + o(1)\big)$ and $f(r) = \frac{r^{c-1}}{B(c,d)}\big(1 + o(1)\big)$, hence $\int_0^r F(t)\,dt = \frac{r^{c+1}}{c(c+1)B(c,d)}\big(1 + o(1)\big)$, and (A.4) gives

$$\lim_{r\to 0} \frac{d}{dr}\underline{e}_B(r) = \lim_{r\to 0} \frac{f(r)\int_0^r F(t)\,dt}{F(r)^2} = \frac{c}{c+1}. \tag{A.8}$$

Next, since $F(r) \to 0$ and $\overline{e}_B(r) \to \mu$ as $r \to 0$, equation (A.1) gives $\lim_{r\to 0} \frac{d}{dr}\overline{e}_B(r) = f(0^+)\,\mu$. Symmetrically, since $F(r) \to 1$ and $\underline{e}_B(r) \to \mu$ as $r \to 1$, equation (A.2) gives $\lim_{r\to 1} \frac{d}{dr}\underline{e}_B(r) = f(1^-)\,(1-\mu)$. From the form of the density, $f(0^+) = 0$ when $c > 1$, and $f(1^-) = +\infty$ when $d < 1$.

Suppose $c > 1$. Then $\frac{d}{dr}\overline{e}_B(r) \to 0$ while, by (A.8), $\frac{d}{dr}\underline{e}_B(r) \to \frac{c}{c+1} > 0$, so condition (i) fails on a neighborhood of $r = 0$. Suppose instead $d < 1$. Then $\frac{d}{dr}\underline{e}_B(r) \to +\infty$, so condition (ii) fails on a neighborhood of $r = 1$. In either case, at least one of the two conditions fails, which completes the proof. □

B Proofs

B.1 Proof of Proposition 3.1

Proof. Since both qualities are drawn from the same prior, the RHS of (3.8) is the same function for the two candidates, and it depends on the rival's cutoff only through $t = F(r_{-J}) \in [0,1]$. Collecting terms,

$$H(r;t) \;=\; \big[\,r - \underline{e}_j(r)\,\big] \;+\; (1-\alpha)\,t\,\big[\,\overline{e}_j(r) - r\,\big], \tag{B.1}$$

so candidate j's best response to r_{-J} solves $H(r;t) = D_j$ at $t = F(r_{-J})$.

Part (a). *Best Response:* From proof of Lemma 3.2, $\lim_{r\to 0} H(r;t) = (1-\alpha)\mu t$ and $\lim_{r\to 1} H(r;t) = 1-\mu$, and conditions (i) and (ii) give, through (A.3), $\frac{\partial H}{\partial r}(r;t) \ge \big(1 - \frac{d}{dr}\underline{e}_j(r)\big)\big[1-(1-\alpha)t\big] > 0$ for every $t \in [0,1]$. Hence whenever

$$(1-\alpha)\,\mu\,t \;<\; D_j \;<\; 1-\mu, \tag{B.2}$$

equation $H(r;t) = D_j$ has a unique solution in $(0,1)$, which is candidate j's best response.
Relevant range of cutoffs: Since $\overline{e}_j(r) > r$ on $(0,1)$, equation (B.1) gives $H(r;t) \ge r - \underline{e}_j(r)$ for every $t \in [0,1]$. Evaluating at an interior best response $\tilde{r}_j$ and using $H(\tilde{r}_j;t) = D_j$,

$$\tilde{r}_j - \underline{e}_j(\tilde{r}_j) \;\le\; D_j \;=\; \tilde{r}_j(0) - \underline{e}_j\big(\tilde{r}_j(0)\big),$$

so $\tilde{r}_j \le \tilde{r}_j(0)$ because $r - \underline{e}_j(r)$ is strictly increasing: no best response exceeds the cutoff chosen against a rival who never campaigns on identity. The same monotonicity and $D_B \le D_A$ give $\tilde{r}_B(0) \le \tilde{r}_A(0)$.

Interior: Note that we have $(1-\alpha)\mu F\big(\tilde{r}(0)\big) \le (1-\alpha)\mu < D_B$. Now, let $\mathcal{K} = [0, \tilde{r}_A(0)] \times [0, \tilde{r}_B(0)]$. For $r_A \le \tilde{r}_A(0)$, monotonicity of F and $(1-\alpha)\mu < D_B$ give $(1-\alpha)\mu F(r_A) \le (1-\alpha)\mu F\big(\tilde{r}_A(0)\big) < D_B$; for $r_B \le \tilde{r}_B(0) \le \tilde{r}_A(0)$ the same chain gives $(1-\alpha)\mu F(r_B) < D_B \le D_A$. Together with $D_B \le D_A < 1-\mu$, condition (B.2) holds for both candidates at every point of $\mathcal{K}$, so both best responses are well defined and interior there, and the best-response map carries $\mathcal{K}$ into itself.

Continuity: The limits in best response are continuous in t, so H extends continuously to $[0,1] \times [0,1]$. Take $t_n \to t$ in $[0,1]$ and let r_n solve $H(r_n; t_n) = D_j$. Any limit point ρ of (r_n) satisfies $H(\rho; t) = D_j$ by joint continuity, and $H(\cdot\,; t)$ is strictly increasing, so ρ is the unique solution at t and r_n converges to it. The best response is therefore continuous in t, and since F is continuous, it is continuous in the rival's cutoff on $\mathcal{K}$. This argument does not require f to be bounded, which matters because f is assumed continuous only on the open interval.

Fixed point; Now since $(r_A, r_B) \mapsto \big(\tilde{r}_A(r_B), \tilde{r}_B(r_A)\big)$ is a continuous map from the nonempty, compact and convex set $\mathcal{K}$ into itself. Brouwer's theorem ensures a fixed point (r_A^*, r_B^*), which is an equilibrium. Each coordinate is an interior best response, so $(r_A^*, r_B^*) \in (0,1)^2$.

Part (b). Differentiating (3.8) with respect to r_A,

$$\frac{\partial H}{\partial r_A} = f(r_A)\big[\alpha r + (1-\alpha)\overline{e}_B(r) - r\big] = (1-\alpha)\, f(r_A)\big[\overline{e}_B(r) - r\big].$$

Since $f > 0$ on $(0,1)$ and $\overline{e}_B(r) - r = \frac{\int_r^1 (t-r) f(t)\,dt}{1-F(r)} > 0$, we have $\partial H/\partial r_A > 0$. At an interior best response $H'(\tilde{r}_B) > 0$ by Step 1, so the implicit function theorem applies at $(\tilde{r}_B, r_A)$ and yields (3.10), whose sign is negative because numerator and denominator are both strictly positive.

Under the uniform prior, $f \equiv 1$, $\overline{e}_B(r) - r = \frac{1-r}{2}$, and $\frac{d}{dr}\overline{e}_B = \frac{d}{dr}\underline{e}_B = \frac{1}{2}$, so (A.3) gives $H'(r) = \frac{1-(1-\alpha)r_A}{2}$. Substituting into (3.10),

$$\frac{d\tilde{r}_B}{dr_A} = -\,\frac{(1-\alpha)(1-\tilde{r}_B)}{1-(1-\alpha)r_A},$$

which is the slope of the closed-form reaction function of Lemma 3.3 evaluated at $\tilde{r}_B(r_A)$.

□

B.2 Proof of Lemma 3.3

Proof. We provide the proof for $\tilde{r}_B(r_A)$, then $\tilde{r}_A(r_B)$ follows similarly. Notice that the difference Δ is increasing in q. Therefore, we get a cutoff $q^* = r_B$ above which candidate

B reveals his quality (engages in programmatic campaign) and below, which she does not reveal (emphasis on group identity). Then the difference can be rewritten as,

$$\begin{aligned}
\int_0^1 \Delta dF &= \int_{r_A}^1 [(q - \underline{e}_B) - D_B - (1-\alpha)(q_A - \overline{e}_A)]\, dF \\
&\quad + \int_0^{r_A} [[\alpha q + (1-\alpha)\overline{e}_B - \underline{e}_B] - D_B]\, dF \\
&= [(q - \underline{e}_B) - D_B]\,[1 - F(r_A)] - (1-\alpha)\int_{r_A}^1 (q_A - \overline{e}_A) dF \\
&\quad + F(r_A)\,([\alpha q + (1-\alpha)\overline{e}_B - \underline{e}_B] - [a\beta_B - b\beta_A]) \\
&= -\underline{e}_B - D_B + [1 - F(r_A)]q + F(r_A)[\alpha q] + F(r_A)[(1-\alpha)\overline{e}_B] \\
&= -\underline{e}_B - D_B + q[1 - F(r_A)(1-\alpha)] + F(r_A)(1-\alpha)\overline{e}_B
\end{aligned}$$

Now, at the equilibrium, $q = r_B$, we must have $\int_0^1 \Delta dF = 0$. Hence,

$$r_B[1 - F(r_A)(1-\alpha)] = \underline{e}_B + D_B - F(r_A)(1-\alpha)\overline{e}_B$$

Now, with the uniform distribution we will have $F(r_A) = r_A$, $\underline{e}_B = \frac{r_B}{2}$, and $\overline{e}_B = \frac{1+r_B}{2}$. Hence, we must have:

$$\begin{aligned}
r_B[1 - r_A(1-\alpha)] &= \frac{r_B}{2} + D_B - r_A(1-\alpha)\frac{(1+r_B)}{2} \\
r_B[1 - r_A(1-\alpha)] &= D_B - \frac{r_A}{2}(1-\alpha) + \frac{r_B}{2} - r_A(1-\alpha)\frac{r_B}{2} \quad \text{(where } D_B = a\beta_B - b\beta_A\text{)} \\
\frac{r_B}{2}[1 - r_A(1-\alpha)] &= D_B - \frac{r_A}{2}(1-\alpha) \\
r_B &= \frac{2D_B - r_A(1-\alpha)}{1 - r_A(1-\alpha)} = 1 + \frac{2D_B - 1}{1 - r_A(1-\alpha)}
\end{aligned}$$

Similarly, we can prove that $r_A = 1 + \frac{2D_A - 1}{1 - r_B(1-\alpha)}$. Moreover, since $\frac{dr_j}{dr_{-J}} = \frac{(2D_j - 1)(1-\alpha)}{\left(1 - r_{-J}(1-\alpha)\right)^2} < 0$, cutoffs are strategic substitutes for each other(uniform case of Proposition 3.1). □

B.3 Proof of Proposition 3.2

Proof. Let $\gamma = 1 - \alpha$. By Lemma 3.3, the equilibrium conditions are $(1 - r_A)(1 - \gamma r_B) = 1 - 2D_A$ and $(1 - r_B)(1 - \gamma r_A) = 1 - 2D_B$, or $r_B = \frac{2D_B - \gamma r_A}{1 - \gamma r_A}$. Substituting into the first and rewriting as a quadratic equation, every equilibrium value of r_A is a root of

$$P(r) \;:=\; \alpha\gamma\, r^2 \;-\; \big[\, 1 - \gamma^2 + 2\gamma(D_A - D_B) \,\big]\, r \;+\; 2\big[\, D_A - \gamma D_B \,\big].$$

The leading coefficient is strictly positive, and

$$\begin{aligned}
P(0) &= 2\big(D_A - \gamma D_B\big) > 0, && \text{by Assumption 1, since } D_A > D_B > \gamma D_B,\\
P(2D_A) &= 2\gamma\,(1-2D_A)\big(\gamma D_A - D_B\big) < 0, && \text{by Assumptions 2 and 3,}\\
P(1) &= \alpha\,(2D_A - 1) < 0, && \text{by Assumption 2.}
\end{aligned}$$

Now using intermediate value theorem, since $P(0) > 0$ and $P(2D_A) < 0$, the smaller root r_A^* lies in $(0, 2D_A)$; since $P(1) < 0$ and P is convex, the other root exceeds 1. Hence P has exactly one root in $(0,1)$, and the strict signs at 0 and 1 exclude boundary values. Setting $r_B^* = \tilde{r}_B(r_A^*)$, we get $r_B^* < 1$ because $D_B < \frac{1}{2}$, and $r_B^* > 0$ because $\gamma r_A^* < 2\gamma D_A < 2D_B$, the second inequality being Assumption 3. The equilibrium therefore exists, is unique, and is interior, with $r_A^* < 2D_A$. □

B.4 Proof of Proposition 3.3

Proof. For the interior equilibrium, we know that the reaction functions are

$$\begin{aligned}
r_B &= 1 + \frac{2D_B - 1}{1 - r_A(1-\alpha)}\\
r_A &= 1 + \frac{2D_A - 1}{1 - r_B(1-\alpha)}
\end{aligned}$$

It is enough to prove that the diagonal line $r_A = r_B$ cuts the reaction function $\tilde{r}_A(r_B)$ above the point of intersection of the line $r_A = r_B$ and $\tilde{r}_B(r_A)$.
Substituting into either reaction function gives generic: $\tilde{r}_i(r_{-i})$ at point $r_A = r_B = r$.

$$\begin{aligned}
r &= 1 + \frac{2D - 1}{1 - r(1-\alpha)}\\
(r-1)[1 - r(1-\alpha)] &= 2D - 1
\end{aligned}$$

Differentiating with respect to D yields

$$\begin{aligned}
-(r-1)(1-\alpha)\frac{dr}{dD} + [1 - r(1-\alpha)]\frac{dr}{dD} &= 2\\
\frac{dr}{dD} &= \frac{2}{(1-r)(1-\alpha) + 1 - r(1-\alpha)} > 0
\end{aligned}$$

That is, the equilibrium threshold is strictly increasing in the identity gain D. Since $D_A > D_B$, we must have the $r_A(r_B)$ line cutting the $r_A = r_B$ line above $r_B(r_A)$. Thus, the unique interior equilibrium point (the crossing point of the curves) must be below $r_A = r_B$ in the $(0,1) \times (0,1)$ space as $r_A(r_B)$ starts above $r_B(r_A)$ at $r_A = 0$. □

B.5 Proof of Proposition 3.4

Proof. We will first prove that $\frac{dr_A}{d\beta_A}$ and $\frac{dr_B}{d\beta_A}$ have opposite signs and then prove that $\frac{dr_A}{d\beta_A} > 0$ which imply that. $\frac{dr_B}{d\beta_A} < 0$

$$\begin{aligned}
\frac{dr_B}{d\beta_A} &= \frac{1}{[1-r_A(1-\alpha)]^2}[-2(1-r_A(1-\alpha))(a+b) + (2D_B-1)(1-\alpha)\frac{dr_A}{d\beta_A}] \\
&= \frac{-2(a+b)}{[1-r_A(1-\alpha)]} + \frac{(2D_B-1)(1-\alpha)}{[1-r_A(1-\alpha)]^2}\frac{dr_A}{d\beta_A} \\
\frac{dr_A}{d\beta_A} &= \frac{1}{[1-r_B(1-\alpha)]^2}[[2(1-r_B(1-\alpha))(a+b)] + (2D_A-1)(1-\alpha)\frac{dr_B}{d\beta_A}] \\
&= \frac{2(a+b)}{[1-r_B(1-\alpha)]} + \frac{(2D_A-1)(1-\alpha)}{[1-r_B(1-\alpha)]^2}\frac{dr_B}{d\beta_A}
\end{aligned}$$

We know that $0 < 1 - r_A(1-\alpha) < 1$ and $0 < 1 - r_B(1-\alpha) < 1$. Moreover, $2D_B - 1 < 0$ and $2D_A - 1 < 0$. From the derivative expressions, it is clear that $\frac{dr_A}{d\beta_A} > 0 \implies \frac{dr_B}{d\beta_A} < 0$ and $\frac{dr_B}{d\beta_A} < 0 \implies \frac{dr_A}{d\beta_A} > 0$. Thus, we have $\frac{dr_A}{d\beta_A} > 0 \iff \frac{dr_B}{d\beta_A} < 0$.
Thus, $\frac{dr_A}{d\beta_A}$ and $\frac{dr_B}{d\beta_A}$ have opposite signs.
Let us rewrite temporarily for simplification:

$$\begin{aligned}
\frac{dr_B}{d\beta_A} &= \frac{-2(a+b)}{v} + \frac{(2D_B-1)(1-\alpha)}{v^2}\frac{dr_A}{d\beta_A} \\
\frac{dr_A}{d\beta_A} &= \frac{2(a+b)}{u} + \frac{(2D_A-1)(1-\alpha)}{u^2}\frac{dr_B}{d\beta_A} \\
\frac{dr_B}{d\beta_A} &= \frac{-2(a+b)}{v} + \frac{(2D_B-1)(1-\alpha)2(a+b)}{uv^2} + \frac{(2D_B-1)(2D_A-1)(1-\alpha)^2}{u^2v^2}\frac{dr_B}{d\beta_A} \\
\frac{dr_A}{d\beta_A} &= \frac{2(a+b)}{u} - \frac{(2D_A-1)(1-\alpha)2(a+b)}{u^2v} + \frac{(2D_B-1)(2D_A-1)(1-\alpha)^2}{u^2v^2}\frac{dr_A}{d\beta_A}
\end{aligned}$$

Now, consider $\frac{dr_A}{\partial\beta_A}$, we know that $u > 0,\ v > 0 \implies uv^2 > 0,\ vu^2 > 0$. The first term is positive. In the second term, $2D_A - 1 < 0$ & $(1-\alpha) > 0 \implies$ second term is positive. In the third term $2D_B - 1 < 0$ & $2D_A - 1 < 0 \implies (2D_B-1)(2D_A-1) > 0$. Thus, a sufficient condition for $\frac{dr_A}{d\beta_A} > 0$ will be $\frac{(2D_B-1)(2D_A-1)(1-\alpha)^2}{u^2v^2} < 1$. From the equilibrium conditions in Lemma 3.3, $1 - 2D_j = (1-r_j)(1-r_{-j}(1-\alpha))$, so sufficient condition is

$$\frac{(1-r_A)(1-r_B)(1-\alpha)^2}{uv} < 1$$

Setting $s = r_A + r_B$ and $\gamma = 1-\alpha$, expanding both sides yield the equivalent condition

$$(1-s)\gamma^2 + r_Ar_B\gamma^2 < 1 - s\gamma + r_Ar_B\gamma^2 \implies (\gamma+1)(\gamma-1) < s\gamma(\gamma-1)$$

Since $\gamma - 1 < 0$, this can be rewritten as $\gamma + 1 > s\gamma$ i.e.,

$$\frac{2-\alpha}{1-\alpha} > r_A + r_B.$$

Now, $\frac{2-\alpha}{1-\alpha} = 1 + \frac{1}{1-\alpha} > 2$ for every $\alpha \in (0,1)$, while $r_A + r_B < 2$ at any interior equilibrium. Hence the sufficient condition holds, and we conclude that $\frac{dr_A}{d\beta_A} > 0$ and consequently $\frac{dr_B}{d\beta_A} < 0$. □

B.6 Proof of Proposition 3.5

Proof.

$$\begin{aligned}
\frac{dr_B}{da} &= \frac{2(1-\beta_A)}{1-r_A(1-\alpha)} + \frac{(2D_B-1)(1-\alpha)}{[1-r_A(1-\alpha)]^2}\frac{dr_A}{da} \\
\frac{dr_A}{da} &= \frac{2\beta_A}{1-r_B(1-\alpha)} + \frac{(2D_A-1)(1-\alpha)}{[1-r_B(1-\alpha)]^2}\frac{dr_B}{da}
\end{aligned}$$

Let $x = \frac{dr_A}{da}$ and $y = \frac{dr_B}{da}$, $\gamma = 1 - \alpha$ Now we have

$$x(1 - r_B\gamma) + y\,(1 - r_A)\,\gamma = 2\beta \tag{B.3}$$

$$x(1 - r_B)\gamma + y\,(1 - \gamma r_A) = 2(1 - \beta) \tag{B.4}$$

By subtracting (B.4) from (B.3)

$$(x - y)\,(1 - \gamma) = 2\,(2\beta - 1) \tag{B.5}$$

RHS of (B.5) is positive (but can be very small). Then we must have $x > y$. Can we have $x < 0$? If so, $y < x < 0$. But then, in either equation (B.4) or (B.3), the LHS will be negative since the coefficients are positive. On the other hand, the RHS is positive for both. Hence, we cannot have $x < 0$. The important part is the sign of y. From (B.5),

$$x = y + \frac{2\,(2\beta - 1)}{1 - \gamma} \tag{B.6}$$

Using value of x in (B.3), we get

$$\left[y + \frac{2\,(2\beta-1)}{1-\gamma}\right](1-r_B\gamma) + y\,(1-r_A)\,\gamma = 2\beta$$

$$\begin{aligned}(1-\gamma r_A+\gamma-\gamma r_B)\,y &= 2\beta - \frac{2\,(2\beta-1)}{1-\gamma}(1-r_B\gamma)\\ &= \frac{2}{1-\gamma}\Big[\beta(1-\gamma)-(2\beta-1)(1-r_B\gamma)\Big]\\ &= \frac{2}{1-\gamma}\Big[1-\beta-\gamma\beta+\gamma r_B(2\beta-1)\Big]\\ &> \frac{2}{1-\gamma}\Big[1-\beta-\gamma\beta\Big]\end{aligned}$$

From Assumption 3, we have $\alpha > \frac{D_A-D_B}{D_A} \implies \gamma < \frac{D_B}{D_A} = \frac{a(1-\beta)-b\beta}{a\beta-b(1-\beta)}$. Substituting this bound into the bracketed term gives:

$$\begin{aligned}1-\beta-\gamma\beta &> 1-\beta-\beta\left(\frac{a(1-\beta)-b\beta}{a\beta-b(1-\beta)}\right)\\ &= \frac{a\beta(1-\beta)-b(1-\beta)^2-a\beta(1-\beta)+b\beta^2}{D_A}\\ &= \frac{b(2\beta-1)}{D_A} \geq 0\end{aligned}$$

implying RHS > 0, which implies that $y > 0$ and hence $x > y > 0$.

Now, consider the backlash parameter b,

$$\begin{aligned}\frac{dr_B}{db} &= \frac{-2\beta_A}{1-r_A(1-\alpha)} + \frac{(2D_B-1)(1-\alpha)}{[1-r_A(1-\alpha)]^2}\frac{dr_A}{db}\\ \frac{dr_A}{db} &= \frac{-2(1-\beta_A)}{1-r_B(1-\alpha)} + \frac{(2D_A-1)(1-\alpha)}{[1-r_B(1-\alpha)]^2}\frac{dr_B}{db}\end{aligned}$$

Let $\frac{dr_A}{db} = m$ and $\frac{dr_B}{db} = n$ and $1-\alpha = \gamma$.

$$(1-r_B\gamma)m + (1-r_A)\gamma n = -2(1-\beta) \tag{B.7}$$

$$(1-r_B)\gamma m + (1-r_A\gamma)n = -2\beta \tag{B.8}$$

Subtract (B.8) from (B.7)

$$(1-\gamma)(m-n) = 2(2\beta-1) \tag{B.9}$$

Coefficients of both m and n are positive in equation (B.7), so both m and n cannot be positive as the RHS is negative $(-2(1-\beta))$. So at least one is negative. Note that $m < n < 0 \implies m-n < 0$, thus we can not have $m < n$ as the RHS of (B.9) is positive. Similarly, $m < 0 < n$ is also not feasible. We must have $m > n$. Now either $n < m < 0$

or $n < 0 < m$. From equation (B.9), substitute the value of n in (B.8)

$$
\begin{aligned}
(1-r_B)\gamma m + (1-r_A\gamma)\left[m - \frac{2(2\beta-1)}{1-\gamma}\right] &= -2\beta \\
\big[(1-r_B)\gamma + (1-r_A\gamma)\big]m &= 2(2\beta-1)\frac{1-r_A\gamma}{1-\gamma} - 2\beta \\
&= \frac{2}{1-\gamma}\Big[(2\beta-1)(1-r_A\gamma) - \beta(1-\gamma)\Big] \\
&= \frac{2}{1-\gamma}\Big[-(1-\beta) + \gamma\beta - \gamma r_A(2\beta-1)\Big] \\
&< \frac{2}{1-\gamma}\Big[-(1-\beta) + \gamma\beta\Big]
\end{aligned}
$$

Using the bound $\gamma < \frac{D_B}{D_A}$ derived from Assumption 3:

$$
\begin{aligned}
-(1-\beta) + \gamma\beta &< -(1-\beta) + \beta\left(\frac{a(1-\beta) - b\beta}{a\beta - b(1-\beta)}\right) \\
&= \frac{-a\beta(1-\beta) + b(1-\beta)^2 + a\beta(1-\beta) - b\beta^2}{D_A} \\
&= \frac{b(1-2\beta)}{D_A} \leq 0
\end{aligned}
$$

Hence, for m, the RHS is strictly negative, which means $m < 0$ and hence $n < m < 0$. Moreover, note that as $\alpha \to 1$, $\frac{dr_j}{da} \to 2\beta_J > 0$; and as $\alpha \to 1$, $\frac{dr_j}{db} \to -2\beta_{-J} < 0$. $\square$

B.7 Proof of Proposition 3.6

Proof. Let $\gamma = 1-\alpha$, since D_A and D_B are independent of α, totally differentiating the equilibrium conditions (3.12)–(3.13) with respect to α gives

$$
(1-\gamma r_B)\,\dot r_A + (1-r_A)\,\gamma\,\dot r_B = (1-r_A)\,r_B, \tag{B.10}
$$

$$
(1-r_B)\,\gamma\,\dot r_A + (1-\gamma r_A)\,\dot r_B = (1-r_B)\,r_A, \tag{B.11}
$$

where $\dot r_j := dr_j^*/d\alpha$. To obtain (B.10), note that differentiating (3.12) yields

$$
-\dot r_A(1-\gamma r_B) + (1-r_A)(-\gamma\,\dot r_B + r_B) = 0,
$$

since the right-hand side $1-2D_A$ is constant in α. Rearranging gives (B.10). Equation (B.11) follows analogously from (3.13).

The determinant of the coefficient matrix is say Θ

$$
\Theta = (1-\gamma r_B)(1-\gamma r_A) - (1-r_A)(1-r_B)\,\gamma^2 = \alpha\big[1 + (1-\alpha)(1-r_A-r_B)\big].
$$

Since $r_A, r_B \in (0,1)$ and $\gamma \in (0,1)$, we have $\gamma(r_A + r_B - 1) < \gamma < 1$, so the bracketed term is strictly positive. Hence $\Theta > 0$. Now, by Cramer's rule

$$\dot{r}_A = \frac{(1-r_A)\big[r_B(1-\gamma r_A) - (1-r_B)\, r_A\, \gamma\big]}{\Theta} = \frac{(1-r_A)(r_B - \gamma\, r_A)}{\Theta}, \tag{B.12}$$

$$\dot{r}_B = \frac{(1-r_B)\big[r_A(1-\gamma r_B) - (1-r_A)\, r_B\, \gamma\big]}{\Theta} = \frac{(1-r_B)(r_A - \gamma\, r_B)}{\Theta}. \tag{B.13}$$

Signing $\dot{r}_B$: The numerator factor in (B.13) is $r_A - \gamma\, r_B$. Since $r_A^* > r_B^*$ (Proposition 3.3) and $\gamma < 1$, we have $r_A > r_B > \gamma\, r_B$. Hence $r_A - \gamma\, r_B > 0$ and $\dot{r}_B > 0$, establishing part(i).

Signing $\dot{r}_A$: The numerator factor in (B.12) is $r_B - \gamma\, r_A$. This is strictly positive if and only if $r_B > (1-\alpha)\, r_A$, establishing part (ii).

Now, As $\alpha \to 1$, the reaction functions give $r_j^* \to 2D_j$ for each J. The critical numerator factor becomes $r_B - \gamma\, r_A \to 2D_B - 0 = 2D_B > 0$, where the last inequality follows from Assumption 1. By continuity, $r_B^* > (1-\alpha)\, r_A^*$ holds for all α sufficiently close to 1. Combined with part (i), this establishes part (iii). $\square$

B.8 Proof of Proposition 4.1

Proof. The equilibrium campaign profile partitions $[0,1]^2$ into four rectangles: $R_I = [0, r_A] \times [0, r_B]$ (both identity), $R_{II} = [0, r_A] \times [r_B, 1]$ (A identity, B programmatic), $R_{III} = [r_A, 1] \times [0, r_B]$ (A programmatic, B identity), and $R_{IV} = [r_A, 1] \times [r_B, 1]$ (both programmatic). Now, $\pi_B^k - \frac{1}{2} = \psi T_B^k$, where $T_B^k := (\hat{q}_B - \hat{q}_A) + \sigma_B D_B - \sigma_A D_A$ is the case k expected-utility differential. Using the identity $\pi_A^k q_A + \pi_B^k q_B = \frac{q_A+q_B}{2} + (\pi_B^k - \frac{1}{2})(q_B - q_A)$ and the fact that $\int_0^1\!\int_0^1 \frac{q_A+q_B}{2}\, dq_A\, dq_B = \frac{1}{2}$, we can write $\mathbb{E}[Q^*] = \frac{1}{2} + \psi \sum_k S_k$, where

$$S_k := \iint_{R_k} T_B^k\, (q_B - q_A)\, dq_A\, dq_B.$$

Since $Q^{FI}(q_A, q_B) = \frac{q_A+q_B}{2} + \psi(q_A - q_B)^2$, the welfare loss $L := \mathbb{E}[Q^*]^{FI} - \mathbb{E}[Q^*] = \psi\big(\frac{1}{6} - \sum_k S_k\big) = \psi \sum_k L_k$, where

$$L_k := \iint_{R_k} (q_A - q_B)^2\, dq_A\, dq_B \;-\; S_k. \tag{B.14}$$

Throughout, we use the variance identity $\mathbb{E}[(X-Y)^2] = \mathrm{Var}(X) + \mathrm{Var}(Y) + (\mathbb{E}X - \mathbb{E}Y)^2$ for independent X, Y to evaluate the first term, and compute S_k from the case-k expected-utility differentials T_B^k.

Case IV (both programmatic). On R_{IV}, both qualities are revealed and $T_B^{IV} = q_B - q_A$, which coincides with the full-information benchmark. Hence $S_{IV} = \iint_{R_{IV}} (q_B - q_A)^2\, dq_A\, dq_B$, so $L_{IV} = 0$.

Case I (both identity). On R_I, $T_B^I = (\underline{e}_B - \underline{e}_A) + (D_B - D_A)$ is constant. Hence

$S_I = [(\underline{e}_B - \underline{e}_A) + (D_B - D_A)] \cdot r_A r_B (\underline{e}_B - \underline{e}_A)$. With $q_A \sim U[0, r_A]$ and $q_B \sim U[0, r_B]$ independent on R_I, and using $\underline{e}_j = r_j/2$:

$$\iint_{R_I} (q_A - q_B)^2 \, dq_A \, dq_B = r_A r_B \left[\frac{r_A^2}{12} + \frac{r_B^2}{12} + \frac{(r_A - r_B)^2}{4} \right].$$

Subtracting $S_I = r_A r_B \left[\frac{(r_B - r_A)^2}{4} + \frac{(D_B - D_A)(r_B - r_A)}{2}\right]$ and simplifying:

$$L_I = r_A r_B \left[\frac{r_A^2 + r_B^2}{12} - \frac{(D_A - D_B)(r_A - r_B)}{2} \right]. \tag{B.15}$$

Case II (A identity, B programmatic). On R_{II}, $T_B^{II}(q_B) = C_{II} + \alpha(q_B - \bar{e}_B)$, where $C_{II} := \bar{e}_B - \underline{e}_A - D_A = \frac{1 + r_B - r_A}{2} - D_A$. We decompose:

$$S_{II} = C_{II} \iint_{R_{II}} (q_B - q_A) \, dq_A \, dq_B \; + \; \alpha \iint_{R_{II}} (q_B - \bar{e}_B)(q_B - q_A) \, dq_A \, dq_B.$$

The first integral evaluates to $r_A(1 - r_B)(\bar{e}_B - \underline{e}_A) = r_A(1 - r_B)\frac{1 + r_B - r_A}{2}$. For the second integral, write $q_B - q_A = (q_B - \bar{e}_B) + (\bar{e}_B - q_A)$. The cross term $\iint_{R_{II}} (q_B - \bar{e}_B)(\bar{e}_B - q_A) \, dq_A \, dq_B$ vanishes because $\int_{r_B}^1 (q_B - \bar{e}_B) \, dq_B = 0$. The squared term gives $r_A \int_{r_B}^1 (q_B - \bar{e}_B)^2 \, dq_B = \frac{r_A(1 - r_B)^3}{12}$. Therefore:

$$S_{II} = r_A(1 - r_B) \left[\frac{(1 + r_B - r_A)^2}{4} - \frac{D_A(1 + r_B - r_A)}{2} \right] + \frac{\alpha \, r_A(1 - r_B)^3}{12}.$$

The variance integral on R_{II}, with $q_A \sim U[0, r_A]$ and $q_B \sim U[r_B, 1]$ independent:

$$\iint_{R_{II}} (q_A - q_B)^2 \, dq_A \, dq_B = r_A(1 - r_B) \left[\frac{r_A^2}{12} + \frac{(1 - r_B)^2}{12} + \frac{(1 + r_B - r_A)^2}{4} \right].$$

Subtracting S_{II}, the terms involving $(1 + r_B - r_A)^2/4$ cancel, yielding:

$$L_{II} = r_A(1 - r_B) \left[\frac{r_A^2 + (1 - \alpha)(1 - r_B)^2}{12} + \frac{D_A(1 + r_B - r_A)}{2} \right]. \tag{B.16}$$

Case III (A programmatic, B identity). On R_{III}, $T_B^{III}(q_A) = C_{III} - \alpha(q_A - \bar{e}_A)$, where $C_{III} := \underline{e}_B - \bar{e}_A + D_B$. By a symmetric argument to Case II (with the roles of q_A and q_B interchanged, D_A replaced by D_B, and $r_A \leftrightarrow r_B$ in the appropriate positions):

$$L_{III} = (1 - r_A) r_B \left[\frac{r_B^2 + (1 - \alpha)(1 - r_A)^2}{12} + \frac{D_B(1 + r_A - r_B)}{2} \right]. \tag{B.17}$$

Since $L_{IV} = 0$, we have $L = \psi \, [L_I + L_{II} + L_{III}]$.

$$L = \psi\left[\frac{r_A^3 + r_B^3}{12} + \frac{(1-\alpha)\left[r_A(1-r_B)^3 + r_B(1-r_A)^3\right]}{12} + \frac{D_A r_A(1-r_A) + D_B r_B(1-r_B)}{2}\right].$$

At any interior equilibrium, $r_A^*, r_B^* \in (0,1)$, so the first term is strictly positive. Since $\alpha < 1$, the second term is strictly positive. Since $D_A, D_B > 0$ (Assumption 1) and $r_j^*(1-r_j^*) > 0$, the third term is strictly positive, also $\psi > 0$. Therefore $L > 0$. □

B.9 Proof of Proposition 4.2

Proof. Using $\pi_A + \pi_B = 1$ and $\mathbf{1}\{q_A > q_B\} + \mathbf{1}\{q_B > q_A\} = 1$ a.e., and $\pi_B^k - \frac{1}{2} = \psi T_B^k$ with $T_B^k := (\hat{q}_B - \hat{q}_A) + \sigma_B D_B - \sigma_A D_A$, selection efficiency can be written as

$$SE = \frac{1}{2} + \psi \sum_{k\in\{\mathrm{I,II,III,IV}\}} \Sigma_k, \qquad \Sigma_k := \iint_{R_k} T_B^k \operatorname{sgn}(q_B - q_A)\, dq_A\, dq_B.$$

Each Σ_k requires splitting R_k along the diagonal $q_A = q_B$. At any interior equilibrium, $r_A^* > r_B^*$, so the diagonal intersects the rectangles as follows: it traverses R_I from $(0,0)$ to (r_B, r_B), then R_{II} from (r_B, r_B) to (r_A, r_A), then R_{IV} from (r_A, r_A) to $(1,1)$. The diagonal does not intersect $R_{III} = [r_A, 1] \times [0, r_B]$, since $q_A \geq r_A > r_B \geq q_B$ throughout, so $\operatorname{sgn}(q_B - q_A) = -1$ on all of R_{III}.

Case I (both identity). $T_B^I = (\underline{e}_B - \underline{e}_A) + (D_B - D_A)$ is constant on R_I. The signed area is

$$\iint_{R_I} \operatorname{sgn}(q_B - q_A)\, dq_A\, dq_B = \frac{r_B^2}{2} - \left(r_A r_B - \frac{r_B^2}{2}\right) = -r_B(r_A - r_B),$$

since the region $\{q_B > q_A\} \cap R_I$ has area $r_B^2/2$ and $\{q_A > q_B\} \cap R_I$ has area $r_A r_B - r_B^2/2$. Therefore:

$$\Sigma_I = r_B(r_A - r_B)\left[\frac{r_A - r_B}{2} + (D_A - D_B)\right]. \tag{B.18}$$

Case III (A programmatic, B identity). Since $\operatorname{sgn}(q_B - q_A) = -1$ throughout R_{III}, and $T_B^{III}(q_A) = (\underline{e}_B - \overline{e}_A + D_B) - \alpha(q_A - \overline{e}_A)$:

$$\Sigma_{III} = -\iint_{R_{III}} T_B^{III}\, dq_A\, dq_B = \left[\frac{1 + r_A - r_B}{2} - D_B\right](1 - r_A)\, r_B, \tag{B.19}$$

where we used $\overline{e}_A - \underline{e}_B = (1 + r_A - r_B)/2$ and $\int_{r_A}^1 (q_A - \overline{e}_A)\, dq_A = 0$.

Case IV (both programmatic). $T_B^{IV} = q_B - q_A$, so $T_B^{IV} \operatorname{sgn}(q_B - q_A) = |q_B - q_A|$. We compute:

$$\Sigma_{IV} = \int_{r_A}^1 \int_{r_B}^1 |q_B - q_A|\, dq_B\, dq_A.$$

For each $q_A \in [r_A, 1]$: $\int_{r_B}^{1} |q_B - q_A|\, dq_B = \frac{(q_A - r_B)^2}{2} + \frac{(1-q_A)^2}{2}$. Integrating over q_A:

$$\Sigma_{IV} = \frac{(1-r_B)^3 - (r_A - r_B)^3 + (1-r_A)^3}{6}. \tag{B.20}$$

Case II (A identity, B programmatic). Write $T_B^{II}(q_B) = C_{II} + \alpha(q_B - \bar{e}_B)$, where $C_{II} := \frac{1+r_B-r_A}{2} - D_A$. Then

$$\Sigma_{II} = C_{II} \iint_{R_{II}} \mathrm{sgn}(q_B - q_A)\, dq_A\, dq_B \; + \; \alpha \iint_{R_{II}} (q_B - \bar{e}_B)\, \mathrm{sgn}(q_B - q_A)\, dq_A\, dq_B. \tag{B.21}$$

First integral. The diagonal traverses R_{II} from (r_B, r_B) to (r_A, r_A), creating a triangular sub-region $\{q_A > q_B\} \cap R_{II} = \{q_A \in [r_B, r_A],\; q_B \in [r_B, q_A]\}$ with area $(r_A - r_B)^2/2$. The complementary region $\{q_B > q_A\} \cap R_{II}$ has area $r_A(1-r_B) - (r_A - r_B)^2/2$. Therefore:

$$\iint_{R_{II}} \mathrm{sgn}(q_B - q_A)\, dq_A\, dq_B = r_A(1-r_B) - (r_A - r_B)^2.$$

Second integral. Using $\mathrm{sgn} = 1 - 2 \cdot \mathbf{1}\{q_A > q_B\}$ and $\int_{r_B}^{1} (q_B - \bar{e}_B)\, dq_B = 0$:

$$\iint_{R_{II}} (q_B - \bar{e}_B)\, \mathrm{sgn}(q_B - q_A)\, dq_A\, dq_B = -2 \iint_{\{q_A > q_B\} \cap R_{II}} (q_B - \bar{e}_B)\, dq_A\, dq_B.$$

On the triangle $\{q_A \in [r_B, r_A],\; q_B \in [r_B, q_A]\}$:

$$\begin{aligned} \int_{r_B}^{r_A} \int_{r_B}^{q_A} (q_B - \bar{e}_B)\, dq_B\, dq_A &= \int_{r_B}^{r_A} \left[\frac{(q_A - \bar{e}_B)^2}{2} - \frac{(r_B - \bar{e}_B)^2}{2} \right] dq_A \\ &= \left[\frac{(q_A - \bar{e}_B)^3}{6} \right]_{r_B}^{r_A} - \frac{(1-r_B)^2}{8}(r_A - r_B), \end{aligned}$$

where we used $r_B - \bar{e}_B = -(1-r_B)/2$. Evaluating the cubic term with $\bar{e}_B = (1+r_B)/2$ and simplifying yields

$$\iint_{\{q_A > q_B\} \cap R_{II}} (q_B - \bar{e}_B)\, dq_A\, dq_B = \frac{(r_A - r_B)^2 (2r_A + r_B - 3)}{12}.$$

Combining both parts of (B.21):

$$\Sigma_{II} = C_{II} \big[r_A(1-r_B) - (r_A - r_B)^2 \big] + \frac{\alpha (r_A - r_B)^2 (3 - 2r_A - r_B)}{6}. \tag{B.22}$$

The selection-efficiency loss is $\Lambda = \psi \big[\frac{1}{3} - (\Sigma_I + \Sigma_{II} + \Sigma_{III} + \Sigma_{IV}) \big]$, since $SE^{FI} = \frac{1}{2} + \frac{\psi}{3}$ and $SE = \frac{1}{2} + \psi \sum_k \Sigma_k$. We separate the bracket into identity terms (involving D_A, D_B) and quality terms.

Collecting the coefficients of D_A across $-\Sigma_I$, $-\Sigma_{II}$, and $-\Sigma_{III}$ and simplifying yields

$\Lambda^D = \psi\big[D_A\, r_A(1-r_A) + D_B\, r_B(1-r_B)\big]$.

The remaining contributions from Σ_I through Σ_{IV}, combined with $\frac{1}{3}$, involve only the cutoffs and α. Expanding the non-identity parts of (B.18)–(B.22), collecting, and simplifying yields

$$\Lambda^Q = \psi\left[\frac{r_A^3 + r_B^3}{6} + \frac{(1-\alpha)(r_A - r_B)^2(3 - 2r_A - r_B)}{6}\right].$$

At any interior equilibrium with $r_A^*, r_B^* \in (0,1)$ and $\alpha \in (0,1)$: the first term of Λ^D is positive since $D_A > 0$ and $r_A(1-r_A) > 0$, and similarly for the second. For Λ^Q, the first bracketed term $(r_A^3 + r_B^3)/6 > 0$ is immediate. The second term is strictly positive since $r_A > r_B$ and $3 - 2r_A - r_B > 3 - 2 - 1 = 0$ for $r_A, r_B \in (0,1)$. Therefore $\Lambda = \Lambda^D + \Lambda^Q > 0$ (as $\psi > 0$), which gives $SE < SE^{FI} = \frac{1}{2} + \frac{\psi}{3}$. $\square$

B.10 Proof of Proposition 4.3

Proof. Using $\pi_A = 1 - \pi_B$ and $\mathbf{1}\{q_A < q_B\} + \mathbf{1}\{q_B < q_A\} = 1$

$$\begin{aligned}\pi_A \mathbf{1}\{q_A < q_B\} - \pi_B \mathbf{1}\{q_B < q_A\} &= (1-\pi_B)\mathbf{1}\{q_A < q_B\} - \pi_B \mathbf{1}\{q_B < q_A\} \\ &= \mathbf{1}\{q_A < q_B\} - \pi_B.\end{aligned}$$

Taking expectations over $(q_A, q_B) \sim U[0,1]^2$: Bias $= \frac{1}{2} - \Pr(B \text{ wins})$.

The equilibrium campaign profile partitions $[0,1]^2$ into four rectangles R_k. Writing $\pi_B^k = \frac{1}{2} + \psi T_B^k$, where $T_B^k := (\hat{q}_B - \hat{q}_A) + \sigma_B D_B - \sigma_A D_A$ is the case-k expected-utility differential,

$$\Pr(B \text{ wins}) = \tfrac{1}{2} + \psi \sum_k |R_k|\, \mathbb{E}[T_B^k \mid R_k].$$

Case I (both identity): $T_B^I = (\underline{e}_B - \underline{e}_A) + (D_B - D_A)$ is constant, so

$$|R_I|\, \mathbb{E}[T_B^I] = r_A r_B \left[\frac{r_B - r_A}{2} + (D_B - D_A)\right].$$

Case II (A identity, B programmatic): $T_B^{II}(q_B) = \alpha q_B + (1-\alpha)\bar{e}_B - \underline{e}_A - D_A$. Since $\mathbb{E}[q_B \mid q_B \geq r_B] = \bar{e}_B$, the conditional expectation satisfies $\mathbb{E}[\alpha q_B + (1-\alpha)\bar{e}_B \mid R_{II}] = \bar{e}_B$, giving

$$|R_{II}|\, \mathbb{E}[T_B^{II}] = r_A(1-r_B)\left[\frac{1 + r_B - r_A}{2} - D_A\right].$$

Case III (A programmatic, B identity): $T_B^{III}(q_A) = \underline{e}_B - \alpha q_A - (1-\alpha)\bar{e}_A + D_B$. Since $\mathbb{E}[q_A \mid q_A \geq r_A] = \bar{e}_A$, the conditional expectation satisfies $\mathbb{E}[\alpha q_A + (1-\alpha)\bar{e}_A \mid R_{III}] = \bar{e}_A$, giving

$$|R_{III}|\, \mathbb{E}[T_B^{III}] = (1-r_A)\, r_B\left[D_B - \frac{1 + r_A - r_B}{2}\right].$$

Case IV (both programmatic): $T_B^{IV} = q_B - q_A$, so $\mathbb{E}[T_B^{IV} \mid R_{IV}] = \bar{e}_B - \bar{e}_A = (r_B - r_A)/2$, giving

$$|R_{IV}|\,\mathbb{E}[T_B^{IV}] = (1-r_A)(1-r_B)\frac{r_B - r_A}{2}.$$

Collecting the terms that do not involve D_A or D_B:

$$\begin{aligned} \mathcal{Q} := {} & r_A r_B\,\frac{r_B - r_A}{2} + r_A(1-r_B)\,\frac{1 + r_B - r_A}{2} \\ & - (1-r_A)r_B\,\frac{1 + r_A - r_B}{2} + (1-r_A)(1-r_B)\,\frac{r_B - r_A}{2}. \end{aligned}$$

After expanding, all terms cancel: $\mathcal{Q} = 0$. Thus, in the absence of identity benefits, the expected quality ranking provides no net advantage to either candidate, regardless of the cutoff profile. The coefficients of D_A and D_B across cases are:

$$\begin{aligned} \text{Coefficient of } D_A: &\quad r_A r_B \cdot (-1) + r_A(1-r_B)\cdot(-1) = -r_A, \\ \text{Coefficient of } D_B: &\quad r_A r_B \cdot (+1) + (1-r_A)r_B\cdot(+1) = r_B. \end{aligned}$$

Therefore, $\Pr(B \text{ wins}) = \frac{1}{2} - \psi\big(r_A D_A - r_B D_B\big)$, and

$$\text{Bias} = \tfrac{1}{2} - \Pr(B \text{ wins}) = \psi\big(r_A D_A - r_B D_B\big).$$

At any interior equilibrium, $r_A^* > r_B^* > 0$ (Proposition 3.3) and $D_A > D_B > 0$ (Assumption 1), so $r_A^* D_A > r_B^* D_A > r_B^* D_B$, and since $\psi > 0$, this confirms $\text{Bias} > 0$. $\square$

B.11 Proof of Lemma 4.1

Proof. We prove the result for $\partial L/\partial r_A$; the argument for $\partial L/\partial r_B$ is symmetric. Write $L = \psi\,\ell(r_A, r_B, \alpha)$, where ℓ is the bracketed expression in (4.3). Since $\psi > 0$, it suffices to sign $\partial \ell/\partial r_A$. Differentiating:

$$\frac{\partial \ell}{\partial r_A} = \frac{r_A^2}{4} + \frac{(1-\alpha)\big[(1-r_B)^3 - 3r_B(1-r_A)^2\big]}{12} + \frac{D_A(1-2r_A)}{2}. \tag{B.23}$$

Using equilibrium condition from Lemma 3.3, $(1-r_A)[1-(1-\alpha)r_B] = 1 - 2D_A$, i.e., $D_A = \frac{r_A + r_B(1-\alpha)(1-r_A)}{2}$. Substituting into the third term of (B.23):

$$\frac{D_A(1-2r_A)}{2} = \frac{r_A(1-2r_A)}{4} + \frac{r_B(1-\alpha)(1-r_A)(1-2r_A)}{4}.$$

Combining with the first term: $\frac{r_A^2}{4}+\frac{r_A(1-2r_A)}{4}=\frac{r_A(1-r_A)}{4}$. For the $(1-\alpha)$ terms, combining the contribution from the second and third terms:

$$\begin{aligned}&\frac{(1-\alpha)}{12}\big[(1-r_B)^3-3r_B(1-r_A)^2\big]+\frac{r_B(1-\alpha)(1-r_A)(1-2r_A)}{4}\\&=\frac{(1-\alpha)}{12}\big[(1-r_B)^3-3r_Ar_B(1-r_A)\big]\\&=-\frac{(1-\alpha)r_Ar_B(1-r_A)}{4}+\frac{(1-\alpha)(1-r_B)^3}{12}.\end{aligned}$$

Collecting all terms:

$$\frac{\partial \ell}{\partial r_A}=\frac{r_A(1-r_A)}{4}\big[1-(1-\alpha)r_B\big]+\frac{(1-\alpha)(1-r_B)^3}{12}.$$

At any interior equilibrium with $r_A,r_B\in(0,1)$ and $\alpha\in(0,1)$: $r_A(1-r_A)>0$, $1-(1-\alpha)r_B>0$, and $(1-r_B)^3>0$. Hence $\frac{\partial L}{\partial r_A}\big|_{eq}=\psi\frac{\partial \ell}{\partial r_A}\big|_{eq}>0$. The result for $\frac{\partial L}{\partial r_B}$ follows by the symmetric substitution $D_B=\frac{r_B+r_A(1-\alpha)(1-r_B)}{2}$, giving $\frac{\partial L}{\partial r_B}\big|_{eq}=\psi\left[\frac{r_B(1-r_B)[1-(1-\alpha)r_A]}{4}+\frac{(1-\alpha)(1-r_A)^3}{12}\right]>0$. □

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