Resource Windfalls and Political Sabotage: Evidence from 5.2 Million Political Ads

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Resource Windfalls and Political Sabotage: Evidence from 5.2 Million Political Ads

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Abstract

We study the role of incentives in inducing sabotage in political contents, vis-à-vis natural resource windfalls. The latter induce plausibly exogenous increases in winning payoffs of candidates who compete for executive power, by extending opportunities for private gain or policy implementation upon winning. A model of political contests with exogenous payoffs and endogenous sabotage shows that higher payoffs increase sabotage in political campaigns. We validate these predictions using over 5 million TV ads from U.S. gubernatorial elections (2010-2020), leveraging plausibly exogenous variations in states' natural resource endowments. Results show that resource windfalls significantly escalate negative campaigning: a standard deviation increase in resource windfalls leads to a 10% rise in campaign negativity. We show that this effect is primarily fueled by corruption, and observed most strongly in symmetric, more-competitive, environments.

JEL classifications: Q32, D72, P18

Keywords: Resource windfalls, political sabotage, negative campaigns, contests.

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1 Introduction

Understanding the political implications of natural resource windfalls has long captivated the attention of economists and policymakers, particularly within the context of the so-called 'resource curse' phenomenon.[1] The literature so far highlighted a range of related facets, spanning from the corrupting influence of windfalls to their profound impact on shaping political institutions and macroeconomic outcomes, even within advanced democracies.[2] Little attention, however, was given to the potential impact of natural resource windfalls on the electoral process, a cornerstone of democratic systems. This paper endeavors to fill aspects of this void by examining the conceivable role of resource windfalls in shaping the incentives of political contenders, potentially leading to the emergence of political sabotage. The latter, defined as the costly act of damaging a rival's likelihood of winning the political contest (see Chowdhury and Gürtler, 2015), inflicts various adverse effects, and reduces social welfare.[3]

Our study examines the impact of resource windfalls on political sabotage, both theoretically and empirically, via data on political campaigns in U.S. gubernatorial elections, and finds that unexpected income stemming from natural resource endowments significantly and robustly increase the extent of sabotaging in political campaigns, primarily under symmetric and corrupt environments. Our results shed light on the potential adverse effects of resource windfalls in advanced democracies, as well as more generally on the impact of incentives in political contests.

As initially laid out by Lazear (1989), competing agents are incentivized, and consequently sabotage, based on the contests' stakes. Within political contests, this suggests that political contestants may be incentivized not just merely by the act of winning itself, but also by the winning conditions. For instance, it may be preferable for winning candidates to receive executive powers following an economic boom. Considering this vis-à-vis a benevolent approach, the proceeds from such a boom may help incoming incumbents implement promised policies and thus enhance electoral support for future contests; conversely, adopting a rent-seeking perspective, such proceeds may provide incoming incumbents potential for private gain. We consider this hypothesis via the case of resource windfalls. The latter represent a major, plau-

[1] See Ades and Di Tella (1999); Armand et al. (2020); Brollo et al. (2013); Robinson et al. (2006); Tornell and Lane (1999), and references therein. van der Ploeg (2011), and Venables (2016) provide syntheses of the literature.

[2] See, e.g., Caselli and Tesei (2016); Caselli et al. (2015); James and Rivera (2022); Raveh and Tsur (2020b); van der Ploeg (2018), among others. The related literature is reviewed in more detail in the next section.

[3] Sabotage in tournaments has been shown to reduce productivity (Carpenter et al. (2010); Gürtler et al. (2013); Deutscher et al. (2013)) and the utility of third parties (Charness et al. (2014)), as well as induce adverse selection (Münster (2007)). This extends to political contexts, in which sabotage adversely affects voter turnout (Soubeyran (2009)), trust in democratic processes and the government (Chaturvedi (2005); Lau et al. (2007)), and institutional legitimacy (Gibson (2008)).

sibly exogenous, source of income for economies endowed with natural resources (Arezki et al., 2017). On one hand, they induce economic development at the local level (Cust and Poelhekke, 2015), also within the short-term, thus improving the economic state at which winning candidates commence tenure. On the other hand, they increase corruption and the potential for incumbents' private gain (Caselli and Michaels (2013); James and Rivera, 2022). Put together, resource windfalls may increase contests' winning stakes, hence possibly affecting the behavior of political candidates, including the extent of sabotage.

To examine this, we construct a model of political contests in the spirit of Tullock (1980), building on the micro-foundations of Skaperdas and Grofman (1995) and Lovett and Shachar (2011), with exogenous payoffs and endogenous sabotage. The model considers a (initially symmetric) campaign game of two players who compete over public support via either a positive campaign that enhances their abilities, or a negative one that discredits their adversary's (representing an act of sabotage). The theoretical analysis reveals that when the economy experiences a positive shock that increases the potential payoff for candidates upon their election, their incentives become more pronounced, leading them to incur higher costs in their campaign efforts. Under standard cost structures with diminishing returns from positive campaigns,[4] these higher costs result in a greater divergence between negative and positive campaigning, such that the extent of negative campaigns increases relative to positive ones – in effect, extending Lazear's Hypothesis (1989) to political contests.[5] In addition, considering asymmetric settings in which one of the candidates is in a leading position, we find that trailing candidates tend to go more negative, and that sabotage is relatively higher in symmetric contests, consistent with outcomes of related models (e.g., Skaperdas and Grofman, 1995). We further find, however, that the latter outcome is pronounced under the impact of a payoff-increasing shock.

The model's predictions are corroborated by the empirical analysis. We undertake an empirical investigation of the effect of resource windfalls on political sabotage via examinations of the tone characteristics of political ads related to U.S. gubernatorial elections. The focus on the gubernatorial framework is appealing for our purposes because gubernatorial elections in the U.S. are held independently across states, and unlike other political races (e.g., Presidential, or House/Senate races) they provide executive powers within the state, which is crucial for matching with the potential impact of state resource windfalls vis-à-vis candidate winning payoffs.

[4]The notions that responses to positive and negative information are asymmetric, nonlinear, and that negative information tends to exert greater influence have been well-documented (see, e.g., Holbrook et al. (2001), and further discussion within the theoretical analysis).

[5]Lazear (1989) examined optimal compensation schemes in workplace contests under a central planner, with possible sabotage, pointing at an incentives-sabotage nexus. We examine this nexus in political contests, analyzing contestants' reactions to a shock in political payoffs.

Importantly, U.S. state governments are fiscally autonomous, and benefit from the natural resources located in their territories.[6] In addition, gubernatorial elections are largely bi-partisan, matching well with a simplified 2-player framework, and they alternate across states annually, thus providing a substantive time dimension. An intra-U.S. perspective provides ample cross-state variation in endowments of natural resources, and politico-economic factors, which are central to the analysis. These features closely follow the theoretical setup, and enable examining its main hypotheses.

The analysis is based on two key measures, namely resource windfalls and political sabotage. To measure resource windfalls, we use the state-level, time-varying resource abundance measure constructed in James (2015). In effect, this measure is an interaction of two plausibly exogenous measures: the cross-sectional difference in the geologically-based recoverable stocks of crude oil and natural gas, and the international prices of crude oil and natural gas. The usage of recoverable stocks provides relatively large cross-state variation; in addition, it is highly correlated with changes in oil production and revenues despite being geologically-based, as illustrated by James (2015). As for political sabotage, we measure this via the tone characteristics of political ads related to races for governorship in U.S. states, derived from the Wesleyan Media Project (WMP) for the 2010-2020 races (Fowler et al., 2022). This data covers the universe of TV political ads related to gubernatorial elections broadcasted in (36) major U.S. TV affiliates, across all (210) media markets, covering all state races. It provides a wealth of ad characteristics, ranging from estimated costs to the type of issue raised (all of which exploited in the analysis), including the tone of the ad. Based on the latter, we construct an *Ad Tone Index*, which outlines whether an ad promotes a candidate, contrasts a candidate with an opponent, or attacks an opponent. This index provides a measure of political sabotage that maps to the model, and follows the standard definition in the literature noted initially. Hence, we exploit its considerable variation across states and time, as well as across additional dimensions at the ad and candidate levels, and employ it as the baseline outcome variable. We outline further characteristics of these measures in the empirical section.

To that end, we assembled an annual-based panel of TV political ads across the 48 continental U.S. states and over the period 2010-2020, limited by the availability of our baseline measures. Our data is at the ad level, covering about 5.2 million ads. Our identification strategy throughout the analysis rests on the plausible exogeneity in the variation of natural resource windfalls across states and time. Using a standard fixed-effects framework, we estimate the

[6] These benefits are accrued regardless of whether the natural resources are located on state-owned or federal-owned lands. In the former case state-governments collect severance taxes and royalties. In the latter case they benefit from shared federal revenues that amount to approximately 50% (90% in the case of Alaska) of the royalties paid to the federal government for oil production undertaken on these lands.

contemporaneous impact of resource windfalls on the extent of negative tone in our sample of political ads. In addition, we examine the role of a host of political, economic, as well as candidate and ad level controls, and consider potential underlying mechanisms stemming from these controls as well as from other institutional differences.

We find that when facing a resource windfall, the extent of negative campaigns increases significantly, in an economically meaningful and robust magnitude. Specifically, our baseline estimates indicate that a one standard deviation increase in resource windfalls increases the average extent of campaign negativity by about 10%. We show that the main result is robust to the inclusion of controls across various related dimensions, including measures at the state, ad, candidate, and incumbent levels, as well as to different specifications, sample restrictions, various windfall and sabotage measures, and demanding specifications that include additional fixed effects across the levels examined. Testing for underlying potential mechanisms, via an heterogeneity analysis that considers the main controls and additional differences in political institutions, we find that the main effect is manifested primarily via symmetric settings, specifically when candidates are non-incumbents, electoral competition arises, and parties are institutionally weak, as well as via a corrupt environment (rather than via the state of the economy). The latter outcome emphasizes the role of the potential monetary (corruption-driven) payoff of resource windfalls, relative to that of the electoral (economy-driven) one.

The next section reviews the related literature and places the current contribution within it. Section 3 presents a model that explains how resource windfalls may affect political sabotage. The data, empirical findings, and robustness tests are presented in Section 4. Section 5 concludes and the appendices present data, as well as technical details.

2 Related literature

The paper is related to number of literature strands. First, the literature on the effects of resource booms on development and economic growth. Economists have long noticed that natural resource abundance can turn out to be a blessing as well as a curse. This literature is surveyed by van der Ploeg (2011); Venables (2016) and more recently by Van der Ploeg and Poelhekke (2016) who cover the local effects. Focusing on political perspectives, the literature highlights the key role of democratic institutions in manifesting the impact of resource windfalls, and in turn considers the potential of impact of resource windfalls in shaping these institutions (e.g., Brückner et al. (2012); Haber and Menaldo, 2011), as surveyed in more detail by Deacon (2011). Further studies considered the impact of resource windfalls on processes relating to the electoral process itself, including their potential in giving rise to Petro-Populism (Matsen et al. (2016)), increase incumbent tenure (Andersen and Aslaksen (2013); Smith, 2004), and strengthen electoral participation (Andersen et al. (2014)). We contribute to this literature by pointing to a mechanism that has not yet been explored, namely the potential role of resource windfalls in raising the stakes of political contests and affecting the extent of political sabotage. Theoretically, we link resource windfalls to candidates' incentives within political contests and analyze how this alters their sabotaging decisions, including under asymmetric settings. Empirically, we unravel a significant and robust positive impact of resource windfalls on the extent political sabotage, via the case of negative campaigning in U.S. gubernatorial elections.

Second, the literature on contest theory. As summarized in Chowdhury and Gürtler (2015), several studies in contest theory account for the potential of players to engage in sabotage against one another in various types of contests, ranging from sport tournaments (Deutscher et al., 2013) to lobbying (Konrad, 2000). Considering incentives, Lazear (1989) explored sabotage within firms, demonstrating that compensation schemes based on relative rewards can motivate employees to undermine their colleagues' performance. Baumol (1992) examined a similar hypothesis focusing on innovation across firms. We focus on the role of incentives in inducing sabotage in political contests, which to our best knowledge has been overlooked by the literature. Motivated by the early work of Tullock (1980), and based on micro-foundations drawn from Lovett and Shachar (2011) and Skaperdas and Grofman (1995), we analyze the impact of an increase in the players' reward function on the extent of negative campaigns, within a 2-player campaign game, under symmetric and asymmetric setups. From a theoretical perspective, our contribution is twofold. Firstly, we demonstrate that a positive shock to the players' reward function leads to an increase in negative campaigns relative to positive ones. This change represents not just a nominal shift in the equilibrium effort levels, but a *relative* one, resulting in campaigns that are both more aggressive and more negative. Secondly, we establish that this effect is stronger in symmetric settings compared to asymmetric cases, where one of the candidates has a structural advantage.

Last, the empirical literature on sabotage in contests. The latter have been examined via lab experiments, surveys, and sport events, among others, as surveyed in Chowdhury and Gürtler (2015). Within the political context, examinations of negative campaigns have taken a central role. This vast literature, summarized in Haselmayer (2019) and Maier and Nai (2023a), examines the roles of a wide range of determinants in explaining patterns of negative campaigns, ranging from candidate characteristics to campaign dynamics, which we consider in the empirical analysis. Nonetheless, analyses related to the role of incentives in inducing sabotage in contests tend to focus on contexts outside the realm of politics, or negative campaigning. Del Corral et al. (2010) examined the impact of a change in incentives on sabotage in Spanish Football, pointing at a positive effect. Harbring and Irlenbusch (2005, 2011) and Vandegrift and Yavas (2010) examined this within the lab, noting that sabotage levels increase with increasing prize spread. Our analysis takes this to the political context, examining the impact of incentives, measured via the case of resource windfalls, on the extent of negative campaigning. Consistent with previous findings, we point at a positive effect, and additionally show that it is large, robust, and is most pronounced under a corrupt environment, intensified electoral competition, and non-incumbents, shedding light on the impact of incentives on sabotage under symmetric versus asymmetric settings.

3 The campaign game

The campaign game involves two players, denoted as $i = 1, 2$, who compete over public support. Their ability to do so hinges on either a positive campaign, aimed at enhancing public perception of their abilities, or a negative campaign, intended to discredit their adversary.

Formally, each player i begins with a baseline reputation value of $v_i > 0$. To enhance their standing relative to player $-i$, player i can allocate resources (typically funds) to two distinct campaign channels: a positive channel, denoted as $e_i \geq 0$, which highlights player i's positive attributes, and a negative channel, denoted as $s_i \geq 0$, designed to directly impact the baseline reputation v_{-i} of the opposing player by highlighting player i's negative traits. Consequently, the final reputation of player i is given by the expression:

$$V_i = v_i + e_i^{\alpha} - v_i s_{-i}^{\beta} + \epsilon_i,$$

where $0 < \alpha < \beta < 1$, and $\{\epsilon_1, \epsilon_2\}$ are non-atomic, i.i.d. random variables. We refer to each ϵ_i as the stochastic reputation of player i, which is not directly tied to the campaign itself. Though we broadly discuss the modelling assumptions in Section 3.0.1, let us clarify that the key elements in our framework, and specifically the marginal impact of positive and negative campaigns, are based on various past studies, including Skaperdas and Grofman (1995) and Lovett and Shachar (2011), among others.

The game evolves as follows. Every player i chooses an action profile $a_i = (e_i, s_i) \in \mathbf{R}_+^2$ and incurs a cost of $c(e_i + s_i)$. Here, $c : \mathbf{R}_+ \to \mathbf{R}_+$ is an unbounded, continuously differentiable, strictly convex, and strictly increasing cost function, with $c(0) = 0$. Subsequently, the random variables are realized, leading to the election of the player with the highest reputation, who receives a payoff of $r > 0$. Therefore, given an action profile (a_1, a_2), the expected payoff of player i is

$$\begin{aligned} U_i(a_1, a_2) &= r \Pr(V_i > V_{-i}) - c(e_i + s_i) \\ &= r \Pr(v_i + e_i^\alpha - v_i s_{-i}^\beta + \epsilon_i > v_{-i} + e_{-i}^\alpha - v_{-i} s_i^\beta + \epsilon_{-i}) - c(e_i + s_i) \\ &= rF(v_i - v_{-i} + e_i^\alpha - e_{-i}^\alpha + v_{-i} s_i^\beta - v_i s_{-i}^\beta) - c(e_i + s_i), \end{aligned} \tag{1}$$

where $\epsilon_{-i} - \epsilon_i \sim F$ and F is a continuously differentiable distribution on $\mathbf{R}$, with a probability density function $f(x) = F'(x) > 0$ for every $x \in \mathrm{Supp}(\epsilon_{-\mathrm{i}} - \epsilon_{\mathrm{i}})$.

Our objective, in this section, is to investigate the influence of the payoff r on the equilibria of the *campaign game*. To achieve this, we analyze the equilibria of the game in two scenarios: one in a symmetric setting where $v_1 = v_2$ (Subsection 3.1), and another in an asymmetric setting where $v_1 > v_2$ (Subsection 3.2).

3.0.1 key assumptions

Before proceeding with our analysis, it is essential to address key modeling aspects related to the cost function, the asymmetric impact of positive and negative campaigns, and the game's competitiveness.

Firstly, the convexity of the cost function and the concavity of the voters' response (i.e., $\alpha, \beta < 1$) are grounded in the assumption that fundraising for the campaign and swaying the marginal voter become progressively more challenging. Additionally, the assumption that $\alpha < \beta$ aligns with the concept of asymmetric and non-linear responses to different types of information, where negative information tends to exert a more substantial impact, as estimated by Lovett and Shachar (2011). This phenomenon has been widely observed and documented across various fields, including Political Science, Marketing, and Psychology.[7]

Secondly, the negative campaign of player i directly targets the baseline reputation of player $-i$. We capture this interaction using the term $v_{-i} s_i^\beta$, based on the framework of Skaperdas and Grofman (1995); see Equations (2) and (3) therein. Consequently, with a sufficiently intense negative campaign, the reputation level could potentially decrease below zero. Though this does not present an issue, as the competition primarily involves comparing reputation levels, our framework can be readily adjusted by assuming $c(1) \geq r$. This adjustment ensures that s_i^β

[7] See, for example, Lau (1985); Cacioppo et al. (1997); Ta et al. (1998); Ito and Cacioppo (2000); Baumeister et al. (2001); Holbrook et al. (2001); Klein and Ahluwalia (2005), among many others.

is effectively bounded from above by 1.

Thirdly, to avoid the game becoming trivial, where one player can secure victory with probability 1, and also to remain consistent with empirical evidence, we assume that each player i always has a slight chance of winning the competition. This assumption holds as long as the support of the random variables ϵ_1 and ϵ_2 is sufficiently large (similarly to Lazear (1989); see footnote 3 therein).

Fourthly, it is worth noting that our analysis focuses on the variation in r, resulting from resource windfalls. These windfalls can manifest as direct profits, including various forms of corruption, or as public gains, particularly in terms of candidates' abilities to implement their policies upon election. Consequently, the impact of r on the equilibrium persists, even in scenarios where voters are well-informed about such gains (see, for example, Brender and Drazen, 2008).

Finally, we assume for simplicity that candidates' campaign decisions are not affected by r-induced changes in the electorate's preferences. Rather, as candidates differ in their ideologies and preferred policies, r (resource windfalls) boosts their campaign efforts, subsequently influencing voter behavior. This aligns with the underlying conclusion from Andersen et al. (2014), which suggest that resource windfalls increase electoral participation, potentially mitigating extremism and the consequent hunger for campaign aggressiveness.

3.1 Analysis and theoretical predictions

Let us now proceed with the analysis. To facilitate the exposition, we follow a standard coordinate transformation so that $x_i = e_i^\alpha$ and $y_i = v_{-i}s_i^\beta$. Thus, Equation (1) translates to

$$U_i(a_1, a_2) \quad = \quad rF(v_i - v_{-i} + x_i + y_i - x_{-i} - y_{-i}) - c\left(x_i^{1/\alpha} + \left(\frac{y_i}{v_{-i}}\right)^{1/\beta}\right),$$

and the first-order conditions (FOCs) yield four equations, two for each player i,

$$\frac{\partial U_i(a_1, a_2)}{\partial x_i} \quad = \quad rf(v_i - v_{-i} + x_i + y_i - x_{-i} - y_{-i}) - c'\left([x_i]^{\frac{1}{\alpha}} + \left[\frac{y_i}{v_{-i}}\right]^{\frac{1}{\beta}}\right) \cdot \frac{1}{\alpha} \cdot [x_i]^{\frac{1-\alpha}{\alpha}} = 0,$$
$$\frac{\partial U_i(a_1, a_2)}{\partial y_i} \quad = \quad rf(v_i - v_{-i} + x_i + y_i - x_{-i} - y_{-i}) - c'\left([x_i]^{\frac{1}{\alpha}} + \left[\frac{y_i}{v_{-i}}\right]^{\frac{1}{\beta}}\right) \cdot \frac{1}{v_{-i}\beta} \cdot \left[\frac{y_i}{v_{-i}}\right]^{\frac{1-\beta}{\beta}} = 0,$$

Evidently, the FOCs are not necessary and sufficient conditions for the existence of a Nash equilibrium (NE), and given the generality of the cost function c, as well as the distribution

F, our analysis builds on the assumption that a pure-strategy equilibrium exists (similarly to Lazear (1989) and Deutscher et al., 2013). One can support this assumption in various ways, such as: (i) fixing a specific distribution F; (ii) imposing a quasi-concavity assumption on U_i while applying the equilibrium-existence result of either Browder (1960) or Reny (1999); and (iii) considering a sufficiently convex cost function as in Deutscher et al. (2013) or in Lazear (1989).

Our first result analyzes the basic case where the players are symmetric, i.e., $v_1 = v_2$. Given that an NE exists, the following theorem states that it is also symmetric and unique, while deriving it explicitly. Based on this outcome, we proceed to deduce three significant conclusions regarding the evolution of positive and negative campaigns, in equilibrium, as they relate to the payoff parameter r.

Theorem 1. *Assume that $v_1 = v_2 = v$. Given that a pure-strategy* NE *exists, it is unique, symmetric (i.e., $a_1 = a_2$), and for every i,*

$$e_i^{1-\alpha} c'\left(e_i + s_i\right) = \alpha r f(0), \tag{2}$$

$$s_i^{1-\beta} c'\left(e_i + s_i\right) = v\beta r f(0). \tag{3}$$

There are three main conclusions we can derive from Theorem 1. First, the two equations yield the following relationship:

$$s_i = \left[\frac{v\beta}{\alpha}\right]^{\frac{1}{1-\beta}} e_i^{\frac{1-\alpha}{1-\beta}}.$$

This relationship demonstrates that, in equilibrium, the negative-campaign effort levels strictly increase as a function of the positive ones and the baseline reputation v. Furthermore, the fact that $\frac{1-\alpha}{1-\beta} > 1$ implies that negative-campaign efforts exhibit convexly increasing behavior as a function of the positive ones. Second, both effort levels e_i and s_i are strictly increasing in the reward r. This follows directly from Equations (2) and (3), along with the fact that $c'(\cdot)$ is strictly increasing due to convexity. Third, $s_i \geq e_i$ if and only if $e_i \geq \left[\frac{\alpha}{v\beta}\right]^{\frac{1}{\beta-\alpha}}$. Thus, if the reward r increases (above the equality level), the campaign becomes more negative as relatively more effort is exerted to manifest bad traits rather than good ones. This is because the higher reward incentivizes the players to exert more effort, primarily channeling it into the more rewarding negative campaign.

Figure 1 provides an illustrations for these properties. It depicts both effort levels, in equilibrium, as a function of $rf(0)$, given the quadratic cost function $c(e_i + s_i) = (e_i + s_i)^2$, the

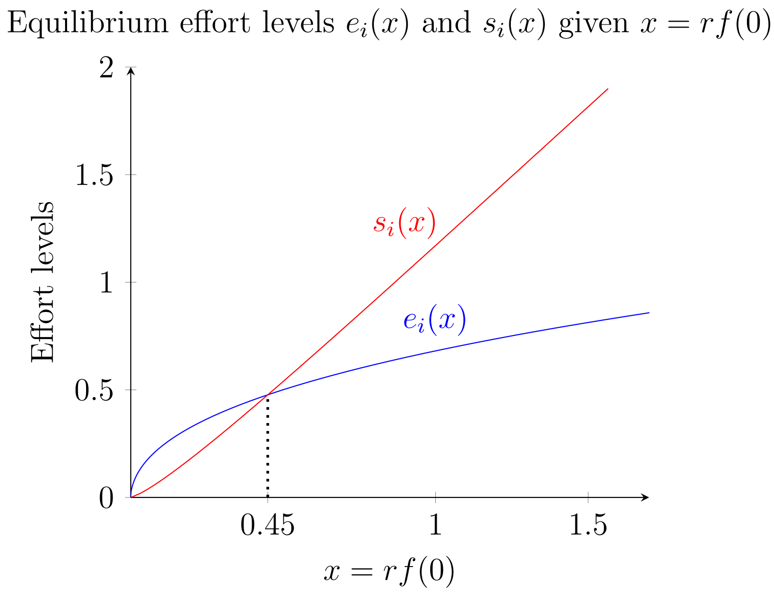

Figure 1: A Comparison of positive and negative campaigning, $e_i(x)$ and $s_i(x)$ respectively, as a function of $rf(0)$, given the quadratic cost function $c(t) = t^2$, parameters $(\alpha, \beta) = (0.5, 0.75)$, and baseline reputation $v = 1$.

parameters $(\alpha, \beta) = (0.5, 0.75)$, and a baseline reputation $v = 1$. One can see that a higher reward r or a higher value $f(0)$, above the equality level, leads to a relatively more negative campaign.

3.2 The asymmetric setup

Now, let us examine a setting in which players are not ex-ante symmetric. To account for this asymmetry, we assume that player 1 enjoys an inherent advantage over player 2 (possibly as an incumbent running for reelection), such that player 1 possesses a baseline reputation that is strictly higher than that of player 2, namely $v_1 > v_2$.

The asymmetric setting allows us to analyze the utilization of different campaign channels in relation to the baseline reputation levels. The following theorem shows that Equations (2) and (3) partially extend to the asymmetric scenario. The theorem also reveals that the "stronger" (player 1) tends to employ a more positive campaign strategy and a less negative one compared to the "weaker" (player 2).

Theorem 2. *Assume that $v_1 > v_2$. Then, in every pure-strategy* NE $(a_1, a_2) = (e_1, s_1, e_2, s_2)$, *the following conditions hold:*

$$
\begin{aligned}
rf(d_{a_1,a_2}) &= c'(e_i+s_i)\cdot\frac{1}{\alpha}\cdot e_i^{1-\alpha}, &(4)\\
rf(d_{a_1,a_2}) &= c'(e_i+s_i)\cdot\frac{1}{\beta v_{-i}}\cdot s_i^{1-\beta} &(5)\\
\text{where } d_{a_1,a_2} &= v_1-v_2+e_1^{\alpha}+v_2 s_1^{\beta}-e_2^{\alpha}-v_1 s_2^{\beta},\\
s_i^{1-\beta} &= \left[\frac{v_{-i}\beta}{\alpha}\right]e_i^{1-\alpha} &(6)\\
e_1 &> e_2,\\
s_2 &> s_1.
\end{aligned}
$$

Several noteworthy conclusions can be drawn from Theorem 2. First, the player in the leading position (in terms of baseline reputation) tends to favor a positive campaign over a negative one compared to the other player. This inclination arises because the trailing player stands to gain more from a negative campaign due to the structural advantage of the leading player. Second, the impact of higher effort levels on sabotage remains consistent with the findings in the symmetric case, as presented in Theorem 1. Once effort levels increase (above the equality level where $e_i = s_i$), players revert to relatively more negative campaigns. Third, when a substantial gap exists between the players' baseline reputations (i.e., $v_1 - v_2 \gg 1$), all effort levels experience a significant decrease. This phenomenon occurs because effort levels are effectively bounded from above by the finite reward r. Consequently, if the gap is wide enough, player 2's (player 1's) probability of losing (winning, respectively) the contest tends to 1 regardless of the chosen (undominated) actions.[8] As a result, both players exert less effort in equilibrium, making their campaigns less negative relative to the symmetric set-up.

Finally, we can deduce that all equilibrium effort levels shift in the same direction as a function of r. To see this, use Equation (6) to note that e_i and s_i jointly increase/decrease, as a function of r, in equilibrium, for every player i. Next, utilize Equations (4) and (5) to arrive at $c'(e_1+s_1)e_1^{1-\alpha} = c'(e_2+s_2)e_2^{1-\alpha}$. Thus, if e_i and s_i increases (decrease) as a function of r, then the last equation implies that both e_{-i} and s_{-i} jointly increase (decrease, respectively) as well.

Note that in both Theorems 1 and 2 all effort levels depend on $rf(d_{a_1,a_2})$, where $d = 0$ in the symmetric case. The subsequent lemma states that $d = 0$ is a global maximum of f, enabling us to study the impact of the reward in the asymmetric framework, compared to the symmetric

[8]It's worth noting that our analysis does not rely on specific distributions; instead, we consider any distribution with a sufficiently wide support. Therefore, the decline need not follow a monotonic pattern.

one.

Lemma 1. *Let ϵ_1 and ϵ_2 be two i.i.d. random variables. Assume that $\epsilon_1 - \epsilon_2 \sim F$, where F is a continuously differentiable* CDF *with convex support $I \subseteq \mathbf{R}$ and a strictly positive density function (i.e., $f(x) > 0$ for every $x \in I$). Then, $x = 0$ is a global maxima of f.*

By combining the results of Lemma 1 with Theorems 1 and 2, along with their conclusions, we can infer that the positive impact of the reward on the equilibrium effort levels is more pronounced in the symmetric case. More formally, let us consider a scenario where there exists a substantial gap between the players' baseline reputations (i.e., $v_1 - v_2 \gg 1$), causing equilibrium effort levels to decrease significantly. In this case, the term d_{a_1,a_2} given in Theorem 2 can be approximated by $d_{a_1,a_2} \approx v_1 - v_2 > 0$, even when subjected to small perturbations in r. Under these conditions, the relationship presented in Equation (4) can be roughly translated to $c'(e_i + s_i)e_i^{1-\alpha} \approx \alpha r f(v_1 - v_2)$, again even when subjected to small variations in r. Since $f(0) > f(v_1 - v_2)$ and considering the monotonicity of e_i and s_i as functions of r, any slight shift in r's value has a less pronounced impact on the equilibrium levels in the asymmetric setting, as captured through the expression $c'(e_i + s_i)e_i^{1-\alpha}$. This dynamic does not occur in the symmetric setting, where d_{a_1,a_2} is always fixed at zero, which is also the strict maximum of f.

Summarizing the main findings from our theoretical analysis, we prove that an increase in the reward encourages both players to invest more effort and incur higher costs, resulting in a relatively more negative campaign rather than a positive one. Furthermore, in asymmetric settings, weaker players tend to engage in more negative campaigning compared to their stronger counterparts. Additionally, we observe that the impact of the reward on sabotage is more prevalent in symmetric, more-competitive settings. These predictions are corroborated empirically.

4 Empirical Analysis

The model above explains how the extent of sabotage in political contests may rise with an increase in the winning payoffs of political candidates. In this section we put this prediction into empirical testing. We do so by considering the role of resource windfalls and their potential impact on the patterns of political campaigns within U.S. gubernatorial election contests.

We consider resource windfalls as a suitable proxy for winning payoffs within political competitions on executive powers, as they (exogenously) induce significant economic implications for economies that are endowed with natural resource stocks, including at the regional level

(Cust and Poelhekke, 2015), affecting the state at which candidates commence tenure. An increase in the value of natural resource stocks, namely the type of windfalls we examine, has been shown to trigger contemporaneous economic booms at the U.S. state level (e.g., Allcott and Keniston (2018); Raveh, 2013) on one hand, and also increase state corruption on the other (James and Rivera, 2022). Considering the former, previous studies have shown that the state of the economy translates to electoral support (e.g., Brender and Drazen, 2008). Hence, (resource-triggered) economic success within election years may represent potential electoral payoffs for winning candidates, either by being credited with the positive implications while entering office, or by extending their ability to implement desired policies upon winning.[9] As for the latter, the observed resource-triggered increase in corruption suggests that resource windfalls represent opportunities for making private gains by incumbents, which corrupt candidates may seek to exploit. Importantly, as we further note below, such windfalls are primarily based on changes in international prices and geologically-entrenched endowments, and hence are plausibly exogenous.

We examine the impact of resource windfalls on the tone characteristics of political campaigns related to U.S. gubernatorial elections. The focus on the latter is appealing for our purposes for several reasons. First, the intra-U.S. fiscally autonomous environment ensures that state governments benefit from their natural resource endowments to a considerable, and economically meaningful extent, via direct (severance) and indirect taxation. Second, the federal structure ensures that gubernatorial elections are undertaken independently across states; in addition, while gubernatorial elections generally occur every four years,[10] they alternate across state-groups annually, hence enabling undertaking an annual-based analysis, which better accounts for related short-term phenomena. Third, unlike other types of political races, e.g. presidential or House/Senate races, in the gubernatorial case winners receive incumbent status, and hence executive powers, within the state, which in turn is crucial for tying potential within-state winning payoffs (resource windfalls) and political incentives during campaigns, as hypothesized in the theoretical framework. Fourth, gubernatorial elections are largely bipartisan, and hence map well to a simplified 2-player setup. Last, while presenting a relatively homogeneous environment, U.S. states provide significant cross-state variation in resource windfalls and political behavior, as we report below, in addition to variation in key aspects of the analysis including political institutions, and various politico-economic measures. These features follow the framework studied in the theoretical analysis, and allow identifying the causal link

[9]Albeit already winning, elections is a repeated game in which incumbents continuously strive for electoral support even in non-election years.

[10]With the exception of NH and VT, which are undertaken every two years.

running from resource booms to the extent of negative political campaigns. Next, we describe the data and methodology in more detail.

4.1 Data and methodology

We examine an annual panel of TV political ads related to the U.S. gubernatorial elections, across the 48 contiguous states, covering the period 2010-2020.[11] All variables are outlined in the Data Appendix. The analysis is based primarily on two key measures, namely resource windfalls and TV political ads. We outline each in detail.

4.1.1 Resource windfalls

To consider natural resource windfalls, we exploit the measure constructed in James (2015), and extend it to 2020. This measure is based on the interaction of two plausibly exogenous variables. The first is the cross-sectional difference in geologically-based recoverable stocks of crude oil and natural gas. This data is derived from the U.S. Geological Survey at the province level, which James (2015) aggregates to the state level.[12] The second is the international prices of crude oil and natural gas. Their interaction provides the (weighted) average state resource endowment, which is then normalized by states' land area.[13]

This measure is appealing for our purposes for several reasons. First, since it is based on geological features and prices that are set in international markets, it provides plausibly exogenous variation in resource windfalls across states as well as within them. Second, it provides ample cross-state variation; specifically, given the usage of recoverable stocks, only eight states have zero natural endowments (and hence no windfalls throughout the sample period).[14] The average natural endowment ranges from none (e.g., DE) to slightly below 8 (TX), in million USD per 1000 square miles, with a mean of 1.3 and a standard deviation of 1.6.[15] This is illustrated in Figure 2, which plots the average level of this measure across the

[11]The sample size and period are restricted by the availability of our baseline measures of resource windfalls and political ads, as we further explain below.

[12]This measure excludes AK and HI. Restricting, together with the corruption measure, the sample to the 48 continental states.

[13]Albeit adopting this measure for the baseline analysis, due to its appealing features, we also examine additional output and price based resource measures, which in addition cover all 50 states, for robustness, later in the analysis.

[14]These states are CT, DE, MA, ME, NH, NJ, RI, VT. Nonetheless, several more states have positive, but close to zero natural endowments, as illustrated in Figure 2.

[15]Notably, the vast cross-state variation enables testing the impact of natural resource windfalls, regardless of their absolute levels. This approach follows the strand of literature that examines the effects of resource booms via the case of U.S. states (e.g., James (2015), Raveh (2013)).

48 continental U.S. states. Importantly, despite being geologically-based, it is highly correlated with changes in oil production and revenues, as illustrated by James (2015).

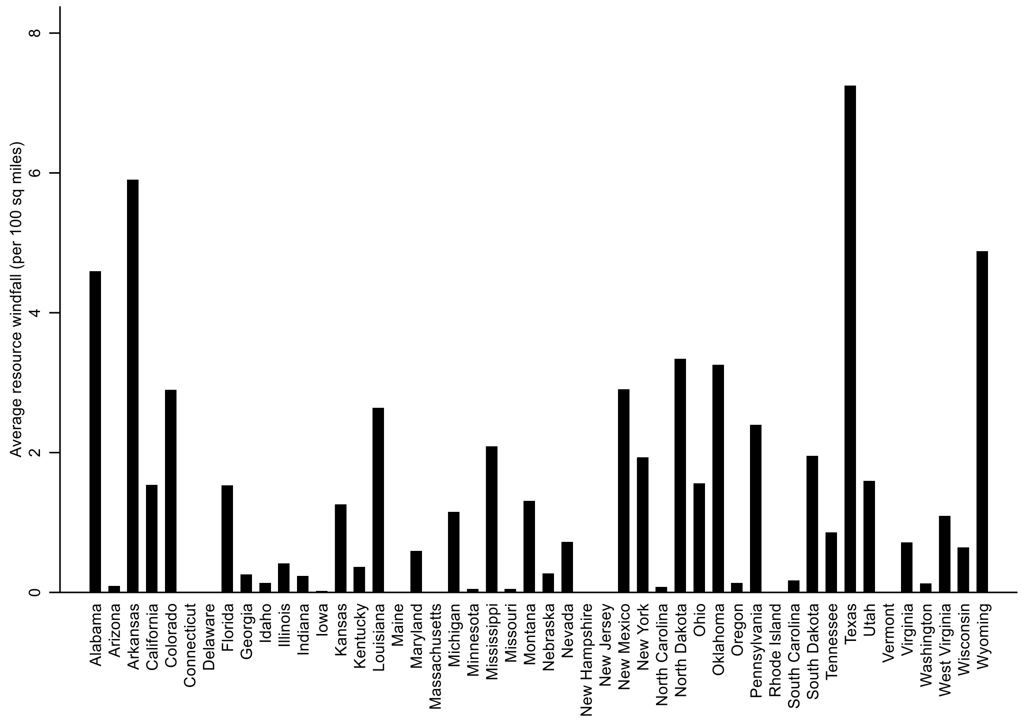

Figure 2: The figure presents the average resource windfall (in $ million) per 100 sq miles across the 48 continental U.S. states over the period 2010–2020.

4.1.2 Political ads

Data on TV political ads come from the WMP (Fowler et al., 2022), which has tracked political advertising on major TV networks, across states and time, since 2010 and up to 2020; since our focus is on gubernatorial elections, the data is annual, with various states participating in each cycle, depending on whether gubernatorial elections are undertaken there in the given year.[16] The Wesleyan data is based on ad tracking by a commercial firm, namely Kantar Media / CMAG, which detects and classifies ads aired in each of the 210 media markets in the U.S.; these data is then processed and (re)coded by the WMP.

The data are at the level of the ad airing, representing an observation; over the sample period, 2010-2020, the baseline sample covers close to 5.2 million ads. For each advertisement

[16]See the Data Appendix for a list of the participating states in each year in the panel.

we observe a host of characteristics that range from the media market, date, time of day, and type of program in which it was aired, to its length, cost, and sponsor. We examine the full set of available ad characteristics in the analysis, with the set alternating across specifications, depending on the case examined. Hence, we outline each measure within the relevant estimated specification in the analysis.

Of the set of ad characteristics, a central one is the tone of the ad. An ad can have a positive tone in which the preferred candidate practices self-promotion,[17] it can have a negative tone in which the preferred candidate attacks a competing candidate, or it may have a contrasting tone in which the ad contrasts between the preferred and competing candidates. The ad tone is (re)coded by WMP, which categorizes each ad into one of three options: promote, contrast, or attack. We exploit this feature for measuring the extent of sabotage, via political campaigns, by considering an *Ad Tone Index*, which follows the WMP coding, taking the values 1-3, as follows: 1 promote, 2 contrast, 3 attack; i.e., it is increasing in the negative tone.

This index provides a direct measure for the endogenous political sabotage defined in the model, and is consistent with the standard definition of political sabotage noted in the literature (e.g., Lazear, 1989); hence, it represents the baseline outcome variable in the analysis. Notably, it has considerable variation across states and time. This is illustrated in Figure 3, which plots the average index level across states, over the sample period. As observed, the average negativity level is 1.86, with a standard deviation of 0.87, and while in states like ND or NE it is less than 1.5, in others like IL and WI, the average is higher than 2. We study the patterns of this measure,[18] focusing on the impact of resource windfalls.

4.1.3 Methodology and identification

Using these primary measures, in addition to further ad and state level controls noted below, as well as throughout the analysis, we estimate the impact of resource windfalls on the extent of negative tone in political ads related to gubernatorial elections, across states and over the period 2010-2020, in election years. Our identification strategy rests on the plausible exogeneity of the resource windfalls measure, which is based on cross-sectional geological features and variations in international commodity prices over time.

Throughout the analysis we estimate models of the following type, for ad a, state i, and date t:

$$tone_{a,i,t} = \varphi + \alpha(windfall)_{i,t} + \beta(\mathbf{X})_{a/i,t} + \nu_t + \eta_i + \epsilon_{a,i,t}, \tag{7}$$

[17]The terms 'candidate', or 'preferred candidate', employed throughout the analysis, refer to the ad's beneficiary.

[18]Albeit also studying additional ones later in the analysis, for robustness.

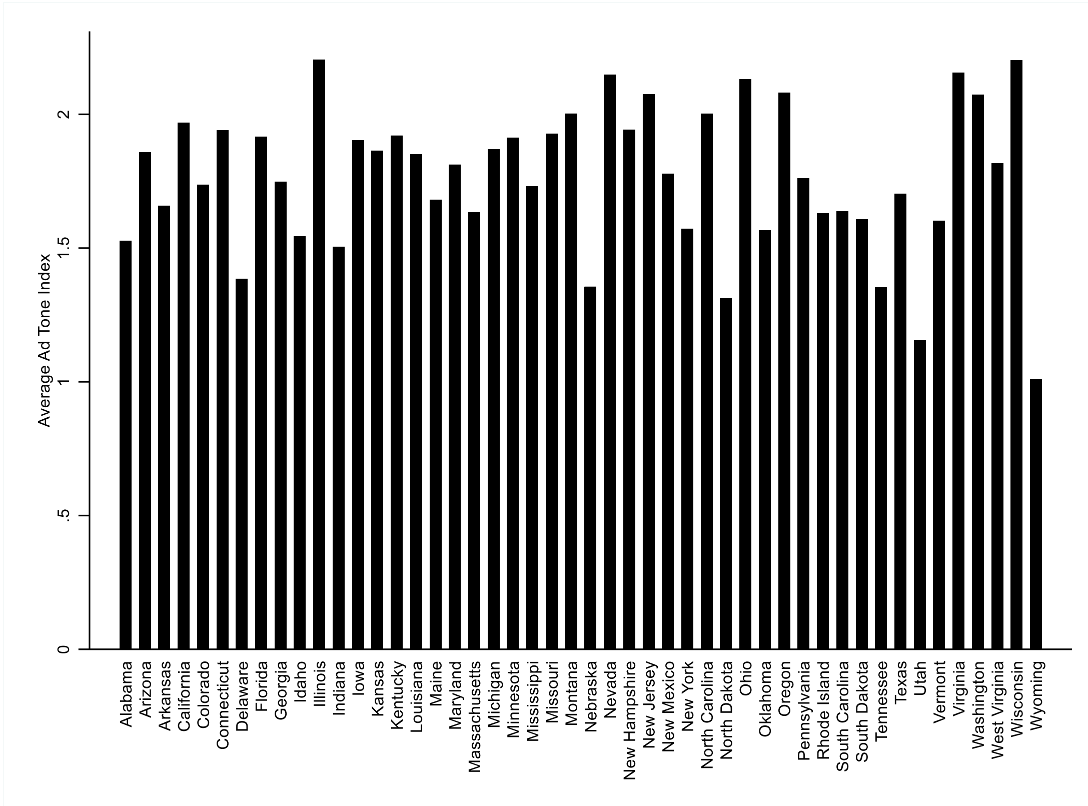

Figure 3: The figure presents the average Ad Tone Index across the 48 continental U.S. states over the period 2010–2020.

where *tone* is the *Ad Tone Index*, *windfall* denotes the resource windfall outlined above, $\mathbf{X}$ is a vector of controls at the ad and/or state level which varies across specifications and outlined across the analysis, and η and ν are state and date fixed effects, respectively. The latter refers to days all across the 2010-2020 period (i.e., not recurring days within a week, or a month), hence the fixed effects absorb fixed month and year effects as well. These fixed effects control for key factors; the within-state approach enables addressing regulatory impacts as well as effects of social political approaches related to, for instance, containment of negative campaigning (giving rise to backlash effects), whereas the time fixed effects absorb impacts related to campaign-seasonality, noting that elections are held in November, as well as other time-specific phenomena, ranging from business cycles to technological shocks. Notably, the baseline model includes state and time (date) fixed effects only. This is so given that the identifying variation of our treatment is across these two dimensions; we seek to estimate within-state effects of resource windfalls across time. Nonetheless, we examine the role of additional ad-level fixed effects throughout the analysis. Our focus throughout the analysis is on the characteristics of α, namely its sign, magnitude and statistical preciseness, which give an estimate for the contemporaneous impact of resource windfalls on campaign negativity. Our contemporaneous approach is driven by the timing of elections, which, as noted, are undertaken late in each given year.[19] Throughout the analysis we adopt a conservative two-way clustering approach, in which the standard errors are clustered by states and dates concurrently.

4.2 Results

This sub-section outlines the results of the empirical analysis. We start with the baseline results, and continue to additional examinations and robustness tests thereafter.

4.2.1 Resource windfalls and negative political campaigns

We turn to the main analysis. We estimate various versions of Equation (7). Results appear in Table 1. Column 1 represents the initial specification, with $\mathbf{X}$ excluded. The results provide support for our main hypothesis. Consistent with the main prediction of the model, we notice that α is positive and statistically precise. This indicates that, in the broad sense, resource windfalls increase the extent of a negative tone in political ads; i.e., facing a windfall of oil and gas, candidates tend to be more aggressive towards their competitors as part of their political campaigns. The magnitude of the effect is not-trivial. The estimated α indicates that a one standard deviation increase in resource windfalls increases the average negative tone of political ads by about 10%.[20]

The next columns include $\mathbf{X}$; each case addresses a different facet of ad patterns. In Column 2 we examine the role of statewide politico-economic factors, focusing on four key measures. First, governors' effects. Governors have a potentially prime role in setting the tone of political intra-state political discussions, depending on various time-invariant characteristics, including for instance gender (e.g., Baskaran et al., 2023). To address that, we add governors' fixed effects to this specification.[21] Second, the economic situation. The latter has been shown to induce political impacts in election years (e.g., Raveh and Tsur, 2020a), hence we include states' per capita Gross State Product (GSP). Third, corruption level. A corrupt environment provides more concrete reasons for attacking political candidates.[22] Therefore, we include standard

[19] In relation, later in the analysis we also examine sample restrictions in which December ads are excluded.

[20] A one standard deviation of windfall, 1.647, multiplied by the estimated α, 0.11, is 0.18, which is approximately 10% of the mean *Ad Tone Index*, 1.864.

[21] Since various governors remain across elections in our sample, cross-governor variation does not absorb our identifying variation.

[22] Consistent with the literature (e.g., Raveh and Tsur, 2023), we define corruption as "criminal abuses of

measures of state corruption. The first is the *Corruption Convictions Index*, which provides a measure of per capita federal convictions relating to corruption. This index is available up to 2014 for our sample period. For 2016 and 2018 we employ the *Corruption Perceptions Index*, which measures reporters' perceptions on the extent of corruption.[23] We then z-normalized each index to construct a unified corruption index for 2010-2020. Last, electoral competition. As highlighted by the model, the degree of symmetry in the political contest may affect the patterns of political sabotage. One aspect of that is the extent of partisan competition, which may for instance pronounce ideological differences over windfall usage, among other things. To account for that, we include a measure of electoral competition; namely, a Ranney-Index based indicator (Ranney, 1976) that takes the value 0 if both the state House and Senate have a majority affiliated with the same party, and 1 otherwise.[24]

The results in Column 2 raise several insights. First, we notice that the extent of electoral competition raises the extent of negativity in political ads, consistent with the theoretical results, and findings of previous related studies (e.g., Lovett and Shachar (2011); Malloy and Pearson-Merkowitz, 2016). Next, corruption is positively associated with the extent of campaign negativity, pointing at a relation between the involvement in corruption and political sabotage. Interestingly, however, the economic situation is negatively associated with campaign negativity, suggesting that economic booms, at least endogenously-driven ones, are not necessarily viewed as winning rewards by candidates, consistent with a view that voters are informed (e.g., Brender and Drazen, 2008), and hence providing some initial affirmation for the potential underlying mechanisms (tested further later on). Importantly, α retains its sign and preciseness, with a similar magnitude, as we observe that windfalls increase sabotage also when accounting for key politico-economic features.

In Column 3 we examine the role of candidate features, at the ad level. Such features represent potentially key determinants of ad patterns (Dato and Nieken (2014), Fridkin and Kenney (2011), Maier and Nai, 2023b), and may also raise asymmetries. First, we control for candidates' time-invariant effects, such as for instance political talent, charisma, or other personal or physical traits, including gender, by adding candidate fixed effects. We, therefore, adopt a demanding within-candidate perspective, which compares the extent of campaign negativity taken by the same candidate, across different windfall levels.[25] Second, we address the

public trust by government officials".

[23]These measures, further outlined in Raveh and Tsur (2023), are derived from the Institute for Corruption Studies, at the Department of Economics at Illinois State University. They have been employed in previous empirical studies on U.S. state corruption; see, e.g., James and Rivera (2022).

[24]This measure is derived from Grossmann et al. (2021). The idea is that once neither party controls both houses, neither is particularly dominant, and the extent of electoral competition increases.

[25]Similar to the case of governors discussed above, some of the candidates run for election in several cycles,

Table 1: Resource windfalls and negative political campaigns

	(1)	(2)	(3)	(4)	(5)
Dependent variable: Ad Tone Index	Baseline	Politico-economic factors	Candidate features	Ad characteristics	Sectoral composition
Resource windfall	0.11***	0.14***	0.51***	0.13***	0.12***
	(0.01)	(0.03	(0.09)	(0.01)	(0.01)
GSP per capita		-0.07***			
		(0.006)			
Corruption		0.13***			
		(0.02)			
Electoral competition		0.15***			
		(0.05)			
Candidate party			0.02***		
			(0.005)		
Ad sponsor			0.15***		
			(0.003)		
Incumbent			-0.15***		
			(0.003)		
Ad length				-0.01***	
				(0.001)	
Ad cost				0.007***	
				(0.001)	
Manufacturing					0.002
					(0.009)
Services					-0.01***
					(0.003)
Wholesale/retail					-0.05***
					(0.01)
Government					-0.08***
					(0.08)
Governor fixed effects	No	Yes	No	No	No
Candidate fixed effecs	No	No	Yes	No	No
Additional fixed effects	No	No	No	Yes	No
R-squared	0.18	0.21	0.83	0.23	0.19
Observations	5190461	4025499	2656860	3867989	5190461

Notes: Standard errors are robust, clustered by state and day, and appear in parentheses for independent variables. Superscripts *, **, *** correspond to a 10, 5 and 1% level of significance. The dependent variable is the ad tone index. All regressions include state and day fixed effects, and an intercept. The sample includes TV political ads related to state gubernatorial elections in the 48 continental states, covering the period 2010-2020 (annually). 'Resource windfall' is the baseline measure of resource windfalls, namely the interaction of the (cross-sectional) state recoverable stocks of oil and gas and the international prices of oil and gas, normalized by states' land area. 'GSP per capita' is the per capita Gross State Product. 'Corruption' is the normalized state corruption index, as outlined in the text. 'Electoral competition' is a Ranney-Index based measure of state electoral competition. 'Candidate party' is the party with which the ad's candidate is affiliated. 'Ad sponsor' is an index denoting the ad's main sponsor. 'Incumbent' is an indicator that captures whether the candidate is an incumbent. 'Ad length' is the length of the ad in seconds. 'Ad cost' is the monetary cost of the ad. 'Manufacturing/services/wholesale-trade/government' is the GSP share of the manufacturing, services, wholesale-trade, and government sectors. 'Additional fixed effects' includes the following ad indicators: media market in which ad aired, television affiliate in which ad aired, time of day during which ad aired, type of television program during which ad aired, and ad's primary issue. For further information on variables see data Appendix.

hence providing variation that extends the state-year level.

potential role of party affiliation (as noted, for instance, by Henderson and Theodoridis, 2018), by including an index that reports the party with which the candidate is affiliated.[26] Third, we account for incumbent advantage. Previous studies note that incumbents running for re-election have an electoral advantage (Falk and Shelton, 2018), and may gain further advantage via Petro-Populism (Matsen et al., 2016). The model indicates that such an advantage may affect the extent of sabotage. To address that, we include an indicator that captures whether the candidate is an incumbent. Last, following Dowling and Wichowsky (2015), noting that the extent of a backlash effect is largely dependent on the degree of candidate involvement in sponsoring the ad, we control for the type of ad sponsor. Specifically, we add a sponsorship index that measures the extent to which the candidate is involved in sponsoring the ad.[27]

The results in Column 3 indicate that the party affiliation index is positively associated with campaign negativity, thus suggesting that candidates affiliated with the Republican party tend to go more negative in their campaigns. Also, we note that the ad sponsor index is positively associated with the outcome variable; consistent with findings of previous studies (Haselmayer, 2019), campaigns turn more negative as the candidate becomes less involved with sponsorship. Furthermore, consistent with the model's predictions concerning candidate asymmetries, incumbents seeking reelection undertake less negative campaigns.[28] In addition, the main result remains to hold, as we observe that resource windfalls increase the extent of negativity, even under a within-candidate analysis. The increased magnitude implies that candidate behavior takes a key role in explaining the impact of windfalls on political sabotage.

Column 4 examines the impact of ad characteristics. As other research notes, ad features contribute to explaining the patterns of negative campaigns (Haselmayer, 2019). The WMP provides a wealth of information on each ad. We exploit the full extent of the main features, including: ad length, ad cost, and ad issue in broad terms (personal-related, policy-related, both, or neither), as well as the media market (210 markets), TV affiliate (36 affiliates), time of day (8 timeslots), and type of program (85 types) in which the ad aired. Ad length and cost are included in $\mathbf{X}$ as controls, as they are continuous. The remaining features enter as additional fixed effects.[29] The results indicate that despite the host of additional ad controls, α retains its

[26]The index is coded as follows: 1 Democrat; 2 Other (including unaffiliated); 3 Republican. Notably, albeit being relatively uncommon in the data, some of the candidates switch affiliations across election cycles, hence this measure is not absorbed by the candidate fixed effects.

[27]The index is coded according to the sponsoring source of the ad as follows: 0 candidate; 1 candidate-party coordination; 2 party; 3 interest group/other.

[28]Consistent as well with the model, the data notes that (non-)incumbents tend to pay more (less) for a positive ad, and less (more) for a negative one, pointing at their relative demands for each ad type. Specifically, the average cost of a positive ad for (non-)incumbents is \$6,895 (\$4,995), and for a negative one it is \$6,477 (\$6,634).

[29]Although ads are aired multiple times, they maintain identical *Ad Tone Index* level across all broadcasts,

characteristics, in similar magnitude. Interestingly, we also observe that relatively shorter ads tend to be less negative, whereas more negative ads tend to be costlier.[30]

Last, in Column 5 we look into the role of sectoral composition. Our focus on the resource sector emanates from its specific features that enable examining the given hypotheses; namely, the plausibly exogenous windfalls it generates, and their oversight by states' executive branch. To further motivate this focus, we examine the potential role of additional major economic sectors. Specifically, we consider states' manufacturing, services, wholesale and retail trade, and government sectors. Each is measured as the GSP share of its respective output, with the exception of government, measured as the GSP share of its expenditures, and all are included in $\mathbf{X}$ as additional controls. The results indicate that the manufacturing sector is not associated with campaign negativity, whereas a boom in the remaining sectors rather decreases it, consistent with the general economic impacts observed earlier via per capita GSP. Moreover, to the extent that larger governments are associated with dominant executive branches, which in turn induces asymmetry in the political contest, the outcome on government is consistent with the related analysis stressed by the model. These results further highlight the role of resource windfalls in inducing negativity.

4.2.2 Potential mechanisms

The baseline results indicate that, consistent with the theoretical analysis, resource windfalls increase the extent of campaign negativity. Next, we consider various potential underlying mechanisms. To do so, we undertake an heterogeneity analysis with respect to the key controls considered in the baseline examinations. Hence, we estimate the following variation of Equation (7):

$$tone_{a,i,t} = \varphi + \alpha(windfall)_{i,t} + \beta(z)_{a/i,t} + \gamma(windfall * z)_{a/i,t} + \nu_t + \eta_i + \epsilon_{a,i,t}, \qquad (8)$$

where z is one of the following measures outlined above: GSP per capita, corruption, government share, electoral competition, candidate party, ad sponsor, ad length, ad cost, and incumbent candidate. Results appear in Table 2. Each column examines each measure, separately, reporting α, β, and γ.

The estimates point at various outcomes. Starting with the role of GSP and corruption. The latter two, appearing in Columns 1 and 2 respectively, refer to the type of political payoff faced by candidates and hence pertain to the two key potential underlying channels considered in the

thus withholding the option of a within-ad analysis. Consequently, ad fixed effects are not included.

[30]The latter result is consistent with the model's outcome on the relatively higher demand for negative campaigning vis-a-vis the relatively greater resources allocated to them.

model. Namely, winning payoffs may increase the extent sabotage via an electoral payoff (state of the economy) or a monetary one (corruption). The baseline outcomes in Table 1 provided an initial affirmation, which is further strengthened via the results in the first two columns of Table 2. Specifically, we note that under a better state of the economy the impact of windfalls on campaign negativity drops significantly, to the point of having zero effect under the highest levels of per capita state product. Conversely, under high levels of state corruption the baseline impact of windfalls on negativity almost triples. These patterns, in turn, highlight the relative importance of the monetary potential of windfalls, associated with candidates' corruption (upon winning), as a transmission channel of the main effect.

Additional outcomes suggest that the impact of resource windfalls on negative campaigning intensifies under stronger electoral competition, a more right-wing candidate ideology, and non-incumbent candidates, thus strengthening the baseline effects noted earlier. In terms of magnitudes, the latter effect points at diverging patterns; (non-)incumbents tend to go (negative) positive, thus indicating that the main effect is driven by non-incumbents. This result is consistent with the model's prediction concerning the intensified impact of $windfall$ in asymmetric settings. As for ad characteristics, we observe that windfalls induce further negativity when candidates are detached from sponsorship, and when ads are longer; the magnitude of $windfall$, however, is reduced, under costlier ads.

4.2.3 Heterogeneous institutions

Additional potential political mechanisms relate to cross-state institutional differences. U.S. states present various institutional differences that may be pivotal for our analysis, as they relate to incumbent behavior, and have been shown to affect corruption (see, e.g., Raveh and Tsur, 2023). We, hence, consider cross-sectional differences in the institutional settings that have been reported in previous research to affect states' incumbent behavior.

While such differences are captured via the state fixed effects, we look into the role of their interaction with $windfall$. As before, this is done to identify the channels via which the impact of $windfall$ on *tone* is manifested, focusing this time on the case of institutions. Hence, we estimate a version of Equation (8) in which z represents an indicator for one of the examined institutional features. The descriptions and cross-sectional state divisions of each of the institutional differences mentioned below are outlined in the Data Appendix, together with their sources. Results appear in Table 3. Each column addresses a separate institutional difference.

We examine the roles of the following cross-state institutional differences: party strength;

Table 2: Potential mechanisms

Dependent variable: Ad Tone Index	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	GSP	Corruption	Government	Electoral Competition	Party	Sponsor	Length	Cost	Incumbent
Resource windfall	0.28***	0.11***	0.09***	0.1***	0.08***	0.03***	0.05**	0.15***	0.15***
	(0.03)	(0.01)	(0.04)	(0.01)	(0.02)	(0.01)	(0.02)	(0.02)	(0.01)
GSP per capita	-0.04***								
	(0.003)								
Corruption		0.06***							
		(0.01)							
Government			-0.07***						
			(0.01)						
Electoral competition				0.14***					
				(0.02)					
Candidate party					0.05***				
					(0.01)				
Ad sponsor						0.28***			
						(0.004)			
Ad length							-0.02***		
							(0.001)		
Ad cost								0.01***	
								(0.02)	
Incumbent									-0.46***
									(0.02)
Resource windfall X GSP per capita	-0.003***								
	(0.001)								
Resource windfall X Corruption		0.05***							
		(0.005)							
Resource windfall X Government			0.001						
			(0.002)						
Resource windfall X Electoral competition				0.09***					
				(0.01)					
Resource windfall X Candidate party					0.03***				
					(0.004)				
Resource windfall X Ad sponsor						0.02***			
						(0.002)			
Resource windfall X Ad length							0.002***		
							(0.001)		
Resource windfall X Ad cost								-0.01***	
								(0.003)	
Resource windfall X Incumbent									-0.09***
									(0.01)
R-squared	0.19	0.2	0.19	0.18	0.19	0.33	0.19	0.21	0.21
Observations	5190461	4434982	5190461	5154947	5190461	5190461	5190461	3899177	3899177

Notes: Standard errors are robust, clustered by state and day, and appear in parentheses for independent variables. Superscripts *, **, *** correspond to a 10, 5 and 1% level of significance. The dependent variable is the ad tone index. All regressions include state and day fixed effects, and an intercept. The sample includes TV political ads related to state gubernatorial elections in the 48 continental states, covering the period 2010-2020 (annually). 'Resource windfall' is the baseline measure of resource windfalls, namely the interaction of the (cross-sectional) state recoverable stocks of oil and gas and the international prices of oil and gas, normalized by states' land area. 'GSP per capita' is the per capita Gross State Product. 'Corruption' is the normalized state corruption index, as outlined in the text. 'Electoral competition' is a Ranney-Index based measure of state electoral competition. 'Candidate party' is the party with which the ad's candidate is affiliated. 'Ad sponsor' is an index denoting the ad's main sponsor. 'Ad length' is the length of the ad in seconds. 'Ad cost' is the monetary cost of the ad. 'Government' is the GSP share of the government sector. 'Incumbent' is an indicator that captures whether the candidate is an incumbent. For further information on variables see data Appendix.

baseline budgeting rules; strict balanced budget requirements; biennial budgeting; debt limitations; direct democracy; legislature term limits; rules of the budget stabilization fund; supermajority vote requirement; tax and expenditure limitations; state upper chamber size; combined tax and spending committees in the legislature; gubernatorial term limits. Results appear in Columns 1-13, examining each of these cases, respectively.

The results indicate that under some of the institutional features the magnitude of the impact of $windfall$ on $tone$ is reduced; namely, biennial budgeting, debt limitations, legislature term limits, state upper chamber size, and gubernatorial term limits. Under other features the magnitude is rather intensified, as observed in the cases of baseline budgeting rules, rules of the budget stabilization fund, supermajority vote requirement, and combined tax and spending committees. However, in one case, party strength, the main effect is not only reduced, but rather reversed. This feature measures the extent to which parties are institutionally involved with the legislature, and hence are stronger. Stronger parties increase the extent of asymmetry in the political contest, as they benefit candidates affiliated with them, and hence consistent with the theoretical analysis, they are expected to reduce campaign negativity. This channel, therefore, further highlights the role of candidate asymmetry in manifesting the key effect observed.

4.2.4 Different measures

The baseline analysis employed specific $windfall$ and $tone$ measures. In this sub-section we examine the robustness of the results to the adoption of various alternatives for each measure. Results appear in Table 4, and follow the baseline specification (Column 1 of Table 1), yet with the examined alternative in lieu of either the baseline $windfall$ or $tone$.

Starting with $windfall$, we examine three alternative measures. The first alternative is state mining output per capita; the mining sector includes the oil and gas industries, and hence provides a different, yet more direct, measure of resource windfalls. The second alternative is an interaction between the consistently resource-rich states over our sample period, and the international price of oil. Since resource-richness is persistent, and (in the case of the U.S.) is largely based on the extent of natural resource endowments, we further minimize the potential endogeneity of our baseline $windfall$ measure and use an indicator that captures the states that have held high measures of oil and gas output (in relative terms) during the sample period. As also partially observed in Figure 2, these states are Alaska, Arkansas, New Mexico, North Dakota, Oklahoma, Texas, and Wyoming. Interacting this indicator with the international price of oil provides plausibly exogenous time variation, reminiscent of the baseline $windfall$ measure.

Table 3: Heterogeneous institutions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Dependent variable: Ad Tone Index	Party strength	Baseline budget	BB strictness	Biennial budget	Debt limit	Direct democracy	Legislature term limit	Rainy day fund	Super-majority voting	Tax and spending limits	Chamber size	Combined committees	Gubernatorial term limits
Resource windfall	0.14***	0.06***	0.13***	0.15***	0.14***	0.11***	0.15***	0.07***	0.08***	0.1***	0.45***	0.05***	0.19***
	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)	(0.06)	(0.02)	(0.02)
ParStrength * Resource windfall	-0.35***												
	(0.04)												
Baseline * Resource windfall		0.23***											
		(0.03)											
Strict * Resource windfall			-0.03										
			(0.02)										
Biennial * Resource windfall				-0.06***									
				(0.02)									
DebtLimit * Resource windfall					-0.04*								
					(0.02)								
DirDem * Resource windfall						-0.0003							
						(0.02)							
LegLimit * Resource windfall							-0.05**						
							(0.02)						
StabFund * Resource windfall								0.06***					
								(0.02)					
Supermajority * Resource windfall									0.62***				
									(0.05)				
TaxLimit * Resource windfall										0.02			
										(0.02)			
Chamber * Resource windfall											-0.01***		
											(0.001)		
Combined * Resource windfall												0.33***	
												(0.03)	
Term limit * Resource windfall													-0.12***
													(0.02)
R-squared	0.19	0.18	0.18	0.18	0.18	0.19	0.18	0.18	0.19	0.18	0.18	0.19	0.18
Observations	5190461	5190461	5190461	5190461	5190461	5190461	5190461	5190461	5190461	5190461	5190461	5190461	5190461

Notes: Standard errors are robust, clustered by state and day, and appear in parentheses for independent variables. Superscripts *, **, *** correspond to a 10, 5 and 1% level of significance. The dependent variable is the ad tone index. All regressions include state and day fixed effects, and an intercept. The sample includes TV political ads related to state gubernatorial elections in the 48 continental states, covering the period 2010-2020 (annually). 'Resource windfall' is the baseline measure of resource windfalls, namely the interaction of the (cross-sectional) state recoverable stocks of oil and gas and the international prices of oil and gas, normalized by states' land area. The various institutional heterogeneities (interacted with 'Resource windfall') are absorbed by the state fixed effects and hence not reported separately. State institutional heterogeneities include: 'Baseline': baseline budgeting rules; 'Strict': strict balanced budget requirements; 'Biennial': semi-annual budget; 'DebtLimit': debt limitations; 'DirDem': direct democracy (voter initiative); 'LegLimit': legislature term limits; 'ItemVeto': line item veto. 'ParStrength': party strength; 'StabFund': rules of the budget stabilization fund; 'Supermajority': supermajority vote requirement; 'TaxLimit': tax and expenditure limitations; 'Chamber': chamber size of the state Senate; 'Combined': combined tax and spending committees in the legislature; 'Gubernatorial term limits': The existence of gubernatorial term limits over the sample period. For further information on variables see data Appendix.

Importantly, these two alternatives enable including Alaska, a highly resource-rich state, which is excluded in the baseline cases. The third alternative is the natural gas component of the baseline $windfall$ measure. Recall, the latter is composed of both oil and gas components; focusing on one enables, in addition, examining their relative importance. The results of each, presented in Columns 1-3, respectively, indicate that the main result is robust to employing different resource windfall measures. In addition, the increased magnitude in Column 3 further suggests that windfalls of natural gas play a key role in the overall effect.

Examining *tone* alternatives, we consider three measures. The first alternative is the *CMAG Tone Index*. This index is similar to the baseline *Ad Tone Index* in its coding and interpretation of each value; however, unlike the baseline measure, which was (re)coded by WMP, this measure was coded by Kantar Media / CMAG, based on their own subjective interpretations. The second alternative is an *Attack Indicator*, which captures whether a TV ad has an attack component. It takes the value of 1 if the ad attacks according to both the *Ad Tone Index*, and the *CMAG Tone Index*, and in addition, if categorized as contrasting by both, then it is also further categorized as attacking more than promoting, as well as finishing the ad by attacking.[31] The third alternative is a *Target Indicator*, which captures whether a targeted, competing, candidate is identified (i.e. in addition to the favored candidate) in the TV ad. The idea is that if one is indeed identified in the ad then, by definition, the ad is either attacking or contrasting, irrespective of the subjective interpretations of CMAG or WMP. These cases are presented in Columns 4-6, respectively. The results indicate that $windfall$ increases *tone*, even under various *tone* alternatives.

4.2.5 Additional tests

We undertake various additional robustness tests to the main specification. All cases follow the baseline specification (Column 1 of Table 1), with case-specific modifications as noted below. Results of this sub-section appear in Table 5. First, we examine three restricted samples. In Column 1 we exclude the three resource-richest states, as observed in Figure 2, namely Arkansas, Texas, and Wyoming. This exclusion enables examining the extent to which the main results are driven by the states with significant resource windfalls, or whether the main result is also apparent even in low-level variations. In Column 2 we exclude New Hampshire and Vermont, to focus on the sample of states that adopt 4-year term lengths. Under this restriction government durability is fixed. In Column 3 we exclude California, New York, and Texas from the sample, to test the robustness of the key results to the exclusion of the three

[31] The latter points, reporting an attack tone within a contrasting ad, refer to additional measures in the WMP data, namely cnt_prp and cnt_fin.

Table 4: Different measures

	(1)	(2)	(3)	(4)	(5)	(6)
	Alternative resource measure			Alternative tone index		
Dependent variable:	Ad tone index	Ad tone index	Ad tone index	CMAG tone index	Attack indicator	Target Indicator
Mining per capita	0.14***					
	(0.02)					
RR x Price		0.002**				
		(0.001)				
Natural gas windfall			0.29***			
			(0.04)			
Resource windfall				0.15***	0.06***	0.12***
				(0.02)	0.01	(0.01)
R-squared, within	0.18	0.18	0.18	0.2	0.22	0.63
Observations	5230055	5230055	5190461	3813307	4268212	5190461

Notes: Standard errors are robust, clustered by state and day, and appear in parentheses for independent variables. Superscripts *, **, *** correspond to a 10, 5 and 1% level of significance. The dependent variable is the ad tone index (Columns 1-3); CMAG tone index (Column 4); attack indicator (Column 5), or target indicator (Column 6), the details of which are outlined in the text and the Data Appendix. All regressions include state and day fixed effects, and an intercept. The sample includes TV political ads related to state gubernatorial elections in the 48 continental states (with the exception of Columns 1 and 2, which cover all (50) states), covering the period 2010-2020 (annually). 'Resource windfall' is the baseline measure of resource windfalls, namely the interaction of the (cross-sectional) state recoverable stocks of oil and gas and the international prices of oil and gas, normalized by states' land area. 'Natural gas windfall' is the natural gas component out of the 'Resource windfall' measure. 'Mining per capita' is state mining output normalized by population. 'RR x Price' is an interaction of the RR indicator, which captures the resource-rich states in our sample, namely Alaska, Arkansas, New Mexico, North Dakota, Oklahoma, Texas, and Wyoming, and the international price of oil. For further information on variables see data Appendix.

largest states. This restriction addresses the concern that the main results may be driven by the dominant states. The estimated α in either of the cases indicates that the main result is robust to these restrictions.

Second, we test different clustering levels. The baseline analysis follows a conservative two-way clustering approach across the two basic dimensions of the data. However, the basic structure of the data enables assuming standard error correlations within various other groups. We examine three such cases; clustering by media market, time of day, and type of program. The results, which appear in Column 4-6, respectively, indicate that the main effect is robust to these modifications.

Last, we make two additional examinations. In the first case, presented in Column 7, we account for state-year time trends, by including them in $\mathbf{X}$. Such state-specific time trends enable controlling for additional related phenomena that occur over time such as changes with respect to preferences over political campaigns, or technological changes related to ads' quality and transmission. In the second case, we exclude the within-year periods that are closer to election time, which may be more campaign-intensive. Election takes place in November. This bears the question of whether the main result is strictly driven by periods around election time, or whether it is also apparent in the quarter farthest from election time; specifically, within the months of December to February. Hence, in Column 8 we restrict the sample to these three months. Notably, the estimated α in both cases indicates that the main outcome holds under these examinations.

Table 5: Additional tests

Dependent variable: Ad Tone Index	(1) AR, TX, and WY excluded	(2) NH, and VT excluded	(3) CA, NY, and TX excluded	(4) Clustering by media market	(5) Clustering by time of day	(6) Clustering by type of program	(7) State time trends	(8) Restricted to December, January, February
Resource windfall	0.04**	0.12***	0.08***	0.11***	0.11***	0.12***	0.13***	0.14***
	(0.015)	(0.01)	(0.014)	(0.04)	(0.02)	(0.01)	(0.01)	(0.03)
R-squared	0.19	0.18	0.2	0.18	0.18	0.19	0.19	0.17
Observations	4968926	5134692	4594119	5190461	5190461	5073584	5190461	849795

Notes: Standard errors are robust, clustered by state and day (by the media market in which ad aired in Column 4; by the time of day during which ad aired in Column 5; by the type of television program during which ad aired in Column 6), and appear in parentheses for independent variables. Superscripts *, **, *** correspond to a 10, 5 and 1% level of significance. The dependent variable is the ad tone index. All regressions include state and day fixed effects, and an intercept. The sample includes TV political ads related to state gubernatorial elections in the 48 continental states (WY, TX, AR are excluded in Column 1; NH, VT are excluded in Column 2; CA, NY, TX are excluded in Column 3), covering the period 2010-2020 (annually); in Column 8 the sample is restricted to the months of December, January, and February. 'Resource windfall' is the baseline measure of resource windfalls, namely the interaction of the (cross-sectional) state recoverable stocks of oil and gas and the international prices of oil and gas, normalized by states' land area. Column 7 includes state-specific time trends as controls. For further information on variables see data Appendix.

5 Conclusion

This work examines, both theoretically and empirically, how resource windfalls influence the extent of political sabotage through patterns of negative campaigning in U.S. gubernatorial elections. We offer a political contest model with endogenous sabotage, vis-à-vis campaigning, and exogenous payoffs. Under standard cost structures with diminishing returns from positive campaigning, the model illustrates that an increase in the candidates' reward functions leads to higher campaign efforts and a shift towards negative campaigning. This shift is more pronounced in symmetric settings compared to scenarios where one of the candidates holds a more dominant position.

The model's predictions are empirically tested using a comprehensive dataset of TV political ads associated with U.S. gubernatorial elections that took place between 2010 and 2020, and plausibly exogenous resource windfalls, regarded as a payoff-increasing shock. These windfalls are significant due to their potential impact on the state of the economy and the opportunities for private gains upon winning. The gubernatorial elections setup, and the tone characteristics of the ads related to it, allow us to align the empirical framework with the model in terms of both the features of the campaign game considered, as well as the definition of the endogenous sabotage measure.

Under these circumstances, we estimate the impact of resource windfalls on the extent of negative tone in our sample of political ads. Our identification strategy rests upon the geologically-based features of the cross-sectional natural resource endowments measure, and the temporal variation in international gas and oil prices. Consistent with the theoretical predictions, the empirical estimates point to a positive, significant, and robust effect of resource windfalls on the extent of negative campaigning. We illustrate that this result is apparent under a host of examinations, including controls and various fixed effects at the state, candidate, and ad levels, and tests of different measures, sample restrictions, and specifications. Testing for possible underlying channels, we show that the main effect is most pronounced under a corrupt environment, and within relatively symmetric cases such as high electoral competition, and non-incumbent candidates.

The results shed light on the potential adverse effects of resource windfalls in advanced democracies, most notably in relation to understanding their role in affecting the electoral process, and highlights, more generally, the role of incentives in political contests. The insights provided yield various policy implications concerning the management of political contests. In particular, an increase in the candidates' stakes within political competition may require implementation of proper regulation, or related mechanisms, for reducing the benefits from political sabotage.

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Appendix A Data

We use an annual-based panel of U.S television political ads over state gubernatorial elections covering the period 2010-2020. The political TV ads data spans the universe of TV political ads related to gubernatorial elections, aired in the major TV networks across states and time, as captured and collected by Kantar Media / CMAG, a commercial firm, and processed and coded by the Wesleyan Media Project (WMP), as described in Fowler et al. (2022). Additional standard state variables are derived from the U.S. Bureau of Economic Analysis (BEA). Variables in monetary-values are in current $USD. Descriptive statistics of the key variables are presented in Table A1.

The sample on political ads includes the 50 states; however, participating states alternate in each year, depending on whether gubernatorial elections are undertaken in the given year. The following is a list of participating states in each year. 2010, 2014, 2018: AK, AL, AR, AZ, CA, CO, CT, FL, GA, HI, IA, ID, IL, KS, MA, MD, ME, MI, MN, NE, NH, NM, NV, NY, OH, OK, OR (also in 2016), PA, RI, SC, SD, TN, TX, VT, WI, WY. 2012, 2016, 2020: DE, IN, KY, LA, MO, MT, NC, ND, NH, UT, VT, WA, WV. 2011, 2015, 2019: KY, LA, MS. 2013, 2017: NJ, VA.

Ad-related variable definitions (source: WMP)[32]

Ad Tone Index: An index that measures the extent to which the TV ad promotes a specific candidate, attacks a candidate, or contrasts the candidates. It takes the values 1-3, and coded by the WMP as follows: 1 promote; 2 contrast; 3 attack.

CMAG Tone Index: An index that measures the extent to which the TV ad promotes a specific candidate, attacks a candidate, or contrasts the candidates. It takes the values 1-3, and coded by Kantar Media / CMAG as follows: 1 promote; 2 contrast; 3 attack.

[32]Variables in this group are at the ad-level.

Table A1: Descriptive statistics

	Mean	Std. Dev.	Min.	Max.
Ad tone index (ad)	1.864	0.877	1	3
CMAG tone index (ad)	1.957	0.921	1	3
Attack index (ad)	0.441	0.497	0	1
Target indicator (ad)	0.388	0.487	0	1
Resource windfall (state; in $million; per 100 sq miles)	1.329	1.647	0	11.788
Mining output per capita (state; in $million)	0.001	0.002	0	0.022
Natural gas windfall (state; in $million; per 100 sq miles)	0.661	0.924	0.000	5.553
Gross State Product per capita (state; in $1000)	49.231	9.788	23.632	84.592
Corruption index, z-normalized (state)	0	1	-2.486	5.102
Electoral competition (state)	0.339	0.473	0	1
Candidate party (ad)	2.048	0.915	1	3
Incumbent (ad)	0.144	0.350	0	1
Ad sponsor (ad)	0.630	1.154	0	3
Ad length, seconds (ad)	30.076	5.497	5	120
Ad cost (ad; in $10000)	0.587	1.838	0.002	228.980
Manufacturing share (state)	0.103	0.041	0.01585	0.207995
Services share (state)	0.326	0.064	0.06271	0.478529
Wholesale and retail share (state)	0.114	0.014	0.06948	0.175302
Government share (state)	0.178	0.034	0.1177	0.34423

Notes: See Appendix for detailed description of variables.

Attack Indicator: A binary indicator that captures whether a TV ad has an attack component. It takes the value of 1 if the ad attacks according to both the Ad Tone Index, and the CMAG Tone Index, and in addition, if categorized as contrasting by both, then it is also further categorized as attacking more than promoting (*cnt_prp* measure in WMP), and finishing the ad by attacking (*cnt_fin* measure in WMP).

Target indicator: A binary indicator that captures whether a targeted, competing, candidate is identified (i.e. in addition to the favored candidate) in the TV ad.

Candidate party: An index, taking the values of 1-3, that records the party with which the candidate is affiliated, coded as follows: 1 Democrat; 2 Other (including unaffiliated); 3 Republican.

Incumbent: An indicator that captures whether the candidate is an incumbent.

Ad sponsor: An index, taking the values of 0-3, that measures the extent to which the candidate is involved in sponsoring the ad, coded as follows, according to the sponsoring source of the ad: 0 candidate; 1 candidate-party coordination; 2 party; 3 interest group/other.

Ad length: Length of the ad in seconds.

Ad cost: Cost of the ad.

Media market: Media market where ad aired (usually at the metropolitan level). The sample

(AK and HI included) includes 210 media markets.

Television affiliate: TV affiliate. The sample includes the following 36 TV affiliates: AB, ABC, ABC/UPN, AZT, AZTA, CAB, CBS, CNN, CW, FOX, FOX/UPN, IND, ION, MFX, MNT, MNTV, Mund, MundoFox, NA, NBC, ND, PAX, SYN, TEL, TLF, UMA, UNI, UPN, UPN/WEB, WB, WB/UPN, WTVT, WV, WVEA, WWSB, and WXPX.

Time of day: The part of day during which ad aired, including: Daytime, Early Fringe, Early Morning, Early News, Late Fringe, Late News, Prime Access, and Prime Time.

Type of program: Type of television program during which ad aired. The sample covers 85 types of television programs.

Primary issue: The primary focus of the ad, in broad terms. Options include: Personal-related issues, policy-related issues, both personal and policy related issues, neither personal nor policy related issues.

State-related variable definitions[33]

Resource windfall: The baseline measure of resource windfalls, constructed as the interaction of the cross-sectional state recoverable stocks of oil and natural gas (AK and HI excluded) and the international prices of crude oil and natural gas, normalized by states' land area. In the computations, the oil and gas recoverable stocks were interacted separately with their respective prices, and then added, prior to normalization. Source of the underlying cross-sectional measure: James (2015).

Mining output per capita: State output in the mining sector, normalized by state population. Source: BEA.

Natural gas windfall: The interaction of the cross-sectional state recoverable stocks of natural gas (AK and HI excluded) and the international prices of natural gas, normalized by states' land area. Source of the underlying cross-sectional measure: James (2015).

GSP per capita: Gross State Product, normalized by state population. Source: BEA.

Corruption index: An index that merges two corruption indices from the Institute for Corruption Studies at Illinois State University. The first is the Corruption Convictions Index, which provides a measure of per capita federal convictions relating to corruption ("criminal abuses of public trust by government officials"), available up to 2014 for our sample period. For 2016 and 2018 we employ the Corruption Perceptions Index, which measures reporters' perceptions on the extent of corruption. Further descriptions are provided in Dincer and Johnston (2017). We z-normalized each index to construct a unified corruption index for 2010-2020. Source of underlying measures: Institute for Corruption Studies, Department of Economics, Illinois State University.

[33] Variables in this groups are at the U.S. state level.

Electoral competition: A binary indicator that takes the value 0 if both the state House and Senate have a majority affiliated with the same party, and 1 otherwise. Source: Grossmann et al. (2021).

Manufacturing share: The GSP share of manufacturing output. Source: BEA.

Services share: The GSP share of services output. Source: BEA.

Wholesale and retail trade share: The GSP share of wholesale and retail trade output. Source: BEA.

Government share: The GSP share of government expenditures. Source: BEA.

State political institutions

Baseline budgeting rules: States are divided based on a binary variable that is 1 for states that use current services baseline, and 0 if they use last year's dollar budget as a baseline. The former group includes: AR, AZ, CT, CO, DE, HI, ME, MA, NV, NC, OH, PA, VT, VA, WV, WY. Source: Crain and Crain (1998).

Biennial budget: States are divided based on a binary variable that is 1 for states that have an annual budget, and 0 if they have a biennial budget. The former group includes: AR, HI, IN, KY, ME, MN, MT, NE, NV, NH, NC, ND, OH, OR, TX, VA, WA, WI, WY. Source: Kearns (1994).

Strict balanced budget requirements: Cross-sectional measure of strict balanced budget requirements based on the Stringency Index of ACIR (1987). The index is a number between 1 (low stringency) and 10 (high stringency) States with a measure below 5 are indexed at 0, whereas the remaining group are marked with 1. States included in the former group are: AK, AR, CA, CT, IL, LA, MA, MD, ME, MI, MN, MS, ND, NH, NV, NY, OR, PA, TX, VA, VT, WA, WI, WY.

Debt limitations: States are divided based on a binary variable that is 1 for states that have debt limitations, and 0 otherwise. The latter group includes: AR, CT, DE, FL, HI, IL, LA, MA, MD, MI, MT, NC, NH, NY, NV, OK, PA, TN, VT. Source: ACIR (1987).

Direct democracy: States are divided based on a binary variable that is 1 for states that have voter initiatives, and 0 otherwise. The former group includes: AK, AR, AZ, CA, CO, FL, ID, IL, MA, ME, MI, MO, MT, NE, NV, ND, OH, OK, OR, SD, UT, WA, WY. Source: Matsusaka (1995).

Legislator term limits: States are divided based on a binary variable that is 1 for states that have no legislator term limits, and 0 otherwise. The former group includes: AK, AL, CT, DE, GA, HI, IA, ID, IL, IN, KS, KY, MA, MD, MN, MS, NC, ND, NH, NJ, NM, NY, OR, PA, RI, SC, TN, TX, UT, VA, VT, WA, WI, WV, WY. Source: National Conference of State Legislatures.

Party strength: States are divided based on a binary variable that is 1 for states with relatively stronger parties based on the Mayhew Index (Mayhew (1986)), and 0 otherwise. The latter group includes: CT, DE, IL, KY, MD, MO, NJ, NY, OH, PA, RI, WV. Source: Primo and Snyder (2010).

Rules of the budget stabilization fund: States are divided based on an indicator that is 0 for states that have no stabilization fund, 1 for states that have such a fund with relatively lax rules, 2 for states that have such a fund with relatively strict rules (strict deposit and withdrawal rules). The first group includes: AL, AR, MT, OR. The latter group includes: AZ, IN, MI, VA. Source: Wagner and Elder (2005).

Supermajority vote requirement: States are divided based on a binary variable that is 1 for states that have supermajority vote requirement, and 0 otherwise. The former group includes: CA, DE, FL, GA, LA, MS, SD. Source: ACIR (1987).

Tax and expenditure limitations: States are divided based on a binary variable that is 1 for states that have tax and expenditure limitations, and 0 otherwise. The former group includes: AK, AZ, CA, CO, HI, ID, LA, MI, MT, NV, OR, RI, SC, TN, TX, UT, WA. Source: ACIR (1987).

Chamber size: Cross-sectional measure of states' upper chamber size. Source: National Conference of State Legislatures.

Combined committees: States are divided based on a binary variable that is 1 for states that have combined tax and expenditure committees, and 0 otherwise. The former group includes: AK, AL, CA, FL, HI, KS, KY, MA, ME, NJ, NY, OK, SC, TN, WI, WV. Source: ACIR (1987).

Gubernatorial term limits: States are divided based on a binary variable that is 1 for states that had gubernatorial term limits over the sample period, and 0 otherwise. The former group includes: AK, AL, AR, AZ, CA, CO, DE, FL, GA, HI, ID, IN, KS, KY, LA, MA, MD, ME, MI, MO, MS, MT, NC, NE, NJ, NM, NV, OH, OK, OR, PA, RI, SC, SD, TN, UT, VA, WA, WV, WY. Source: National Governors Association.

Appendix B Proofs

B.1 Proof of Theorem 1

Proof. We can restrict our analysis of every function $U_i(\cdot, a_{-i})$ to the set $S_i = \{(e_i, s_{-i}) \in \mathbf{R}^2_+ : 0 \leq e_i, s_i \leq c^{-1}(r)\}$, because every other feasible profile is strictly dominated by $(e_i, s_i) = (0, 0)$. Hence, $U_1(\cdot, a_2)$ and $U_2(a_1, \cdot)$ are continuous functions on a compact set and the extreme-value theorem holds.

Using the stated FOCs and the fact that $f(x) > 0$ throughout the support, we deduce that

$$\begin{aligned} \frac{\partial U_i(0, y_i, a_{-i})}{\partial x_i} &= rf(y_i - x_{-i} - y_{-i}) > 0, \\ \frac{\partial U_i(x_i, 0, a_{-i})}{\partial y_i} &= rf(x_i - x_{-i} - y_{-i}) > 0. \end{aligned}$$

Thus, the global maxima of $U_i(\cdot, a_{-i})$ is an interior points of S_i. In other words, the global maximum of $U_i(\cdot, a_{-i})$ is reached when the FOCs are satisfied, and to sustain an equilibrium, all the following four FOCs must be jointly satisfied:

$$\begin{gathered} rf(x_1 + y_1 - x_2 - y_2) = c'\left([x_1]^{\frac{1}{\alpha}} + \left[\tfrac{y_1}{v}\right]^{\frac{1}{\beta}}\right) \cdot \frac{1}{\alpha} \cdot [x_1]^{\frac{1-\alpha}{\alpha}}, \\ rf(x_1 + y_1 - x_2 - y_2) = c'\left([x_1]^{\frac{1}{\alpha}} + \left[\tfrac{y_1}{v}\right]^{\frac{1}{\beta}}\right) \cdot \frac{1}{v\beta} \cdot \left[\tfrac{y_1}{v}\right]^{\frac{1-\beta}{\beta}}, \\ rf(x_2 + y_2 - x_1 - y_1) = c'\left([x_2]^{\frac{1}{\alpha}} + \left[\tfrac{y_2}{v}\right]^{\frac{1}{\beta}}\right) \cdot \frac{1}{\alpha} \cdot [x_2]^{\frac{1-\alpha}{\alpha}}, \\ rf(x_2 + y_2 - x_1 - y_1) = c'\left([x_2]^{\frac{1}{\alpha}} + \left[\tfrac{y_2}{v}\right]^{\frac{1}{\beta}}\right) \cdot \frac{1}{v\beta} \cdot \left[\tfrac{y_2}{v}\right]^{\frac{1-\beta}{\beta}} \end{gathered}$$

Combining every two equations for every player i, we get

$$\frac{1}{\alpha} \cdot [x_i]^{\frac{1-\alpha}{\alpha}} = \frac{1}{v\beta} \cdot \left[\tfrac{y_i}{v}\right]^{\frac{1-\beta}{\beta}},$$

which translates to

$$s_i = \left[\frac{v\beta}{\alpha}\right]^{\frac{1}{1-\beta}} e_i^{\frac{1-\alpha}{1-\beta}}. \tag{9}$$

We conclude that, in equilibrium, s_i and e_i are strictly increasing functions of one another, and by symmetry, if $x_i > x_{-i}$, then $y_i > y_{-i}$.

Next, recall that ϵ_1 and ϵ_2 are i.i.d., so for every i and for every $k \in \mathbf{R}$,

$$\Pr(\epsilon_i - \epsilon_{-i} \leq k) = \Pr(\epsilon_{-i} - \epsilon_i \leq k) = \Pr(\epsilon_i - \epsilon_{-i} \geq -k).$$

This implies that $f(x) = F'(x)$ is symmetric (i.e., $f(k) = f(-k)$ for every $k \in \mathbf{R}$), and

$f(x_1+y_1-x_2-y_2) = f(x_2+y_2-x_1-y_1)$. Using this conclusion and the FOCs above, it follows that

$$\begin{aligned} c'\left([x_1]^{\frac{1}{\alpha}} + \left[\tfrac{y_1}{v}\right]^{\frac{1}{\beta}}\right)\cdot [x_1]^{\frac{1-\alpha}{\alpha}} &= c'\left([x_2]^{\frac{1}{\alpha}} + \left[\tfrac{y_2}{v}\right]^{\frac{1}{\beta}}\right)\cdot [x_2]^{\frac{1-\alpha}{\alpha}}, \\ c'\left([x_1]^{\frac{1}{\alpha}} + \left[\tfrac{y_1}{v}\right]^{\frac{1}{\beta}}\right)\cdot \left[\tfrac{y_1}{v}\right]^{\frac{1-\beta}{\beta}} &= c'\left([x_2]^{\frac{1}{\alpha}} + \left[\tfrac{y_2}{v}\right]^{\frac{1}{\beta}}\right)\cdot \left[\tfrac{y_2}{v}\right]^{\frac{1-\beta}{\beta}}. \end{aligned}$$

Note that all stated terms in the equations above are strictly increasing in x_i and y_i. If $x_i > x_{-i}$, then $y_i > y_{-i}$ as previously stated, and the equations are violated. Thus, $(x_1, y_1) = (x_2, y_2)$ and the unique point that jointly satisfies all FOCs is

$$\begin{aligned} e_i^{1-\alpha} c'(e_i + s_i) &= \alpha r f(0), \\ s_i^{1-\beta} c'(e_i + s_i) &= v\beta r f(0). \end{aligned}$$

for every $i = 1, 2$, as needed. □

B.2 Proof of Theorem 2

Proof. Denote $\Delta v = v_1 - v_2 > 0$. We can follow the same stages given in the proof of Theorem 1. Once we restrict our analysis to the sets S_1 and S_2, we can again use the FOCs to substantiate that every pure-strategy NE is an interior point. Thus, in every such equilibrium, the following FOCs jointly hold:

$$\begin{aligned} rf(\Delta v + x_1 + y_1 - x_2 - y_2) &= c'\left([x_1]^{\frac{1}{\alpha}} + \left[\frac{y_1}{v_2}\right]^{\frac{1}{\beta}}\right)\cdot \frac{1}{\alpha}\cdot [x_1]^{\frac{1-\alpha}{\alpha}}, \\ rf(\Delta v + x_1 + y_1 - x_2 - y_2) &= c'\left([x_1]^{\frac{1}{\alpha}} + \left[\frac{y_1}{v_2}\right]^{\frac{1}{\beta}}\right)\cdot \frac{1}{v_2\beta}\cdot \left[\frac{y_1}{v_2}\right]^{\frac{1-\beta}{\beta}}, \\ rf(-\Delta v + x_2 + y_2 - x_1 - y_1) &= c'\left([x_2]^{\frac{1}{\alpha}} + \left[\frac{y_2}{v_1}\right]^{\frac{1}{\beta}}\right)\cdot \frac{1}{\alpha}\cdot [x_2]^{\frac{1-\alpha}{\alpha}}, \\ rf(-\Delta v + x_2 + y_2 - x_1 - y_1) &= c'\left([x_2]^{\frac{1}{\alpha}} + \left[\frac{y_2}{v_1}\right]^{\frac{1}{\beta}}\right)\cdot \frac{1}{v_1\beta}\cdot \left[\frac{y_2}{v_1}\right]^{\frac{1-\beta}{\beta}}. \end{aligned}$$

Reverting to the original notations, we get

$$\begin{aligned}
rf\left(\Delta v + e_1^{\alpha} + v_2 s_1^{\beta} - e_2^{\alpha} - v_1 s_2^{\beta}\right) &= c'\left(e_1 + s_1\right) \cdot \frac{1}{\alpha} \cdot e_1^{1-\alpha}, \\
rf\left(\Delta v + e_1^{\alpha} + v_2 s_1^{\beta} - e_2^{\alpha} - v_1 s_2^{\beta}\right) &= c'\left(e_1 + s_1\right) \cdot \frac{1}{v_2 \beta} \cdot s_1^{1-\beta}, \\
rf\left(-\Delta v - e_1^{\alpha} - v_2 s_1^{\beta} + e_2^{\alpha} + v_1 s_2^{\beta}\right) &= c'\left(e_2 + s_2\right) \cdot \frac{1}{\alpha} \cdot e_2^{1-\alpha}, \\
rf\left(-\Delta v - e_1^{\alpha} - v_2 s_1^{\beta} + e_2^{\alpha} + v_1 s_2^{\beta}\right) &= c'\left(e_2 + s_2\right) \cdot \frac{1}{v_1 \beta} \cdot s_2^{1-\beta},
\end{aligned}$$

Using the fact that $f(\cdot)$ is symmetric, the first statements of the theorem hold for $d_{a_1,a_2} = \Delta v + e_1^{\alpha} + v_2 s_1^{\beta} - e_2^{\alpha} - v_1 s_2^{\beta}$. In addition, by comparing the first two equations, and the last two accordingly, we get

$$s_i^{1-\beta} = \left[\frac{v_{-i}\beta}{\alpha}\right] e_i^{1-\alpha}, \tag{10}$$

for every $i = 1, 2$.

To show that $e_1 > e_2$ and $s_2 > s_1$, consider the following equation derived from the first and third equations above, using the symmetry of f:

$$c'\left(e_1 + s_1\right) \cdot e_1^{1-\alpha} = c'\left(e_2 + s_2\right) \cdot e_2^{1-\alpha}. \tag{11}$$

Now assume, by contradiction, that $e_2 \geq e_1$. Since $v_1 > v_2$, it follows from Equation (10) that $s_2 > s_1$. However, this implies that $c'\left(e_1 + s_1\right) \cdot e_1^{1-\alpha} < c'\left(e_2 + s_2\right) \cdot e_2^{1-\alpha}$, which violates Equation (11). Thus, we conclude that $e_1 > e_2$. This inequality, along with Equation (11) also suggests that $c'(e_2 + s_2) > c'(e_1 + s_1)$. Because $c'(\cdot)$ is monotone, we conclude that $e_2 + s_2 > e_1 + s_1$. Thus, $s_2 > e_1 + s_1 - e_2 > s_1$, which concludes the proof. □

B.3 Proof of Lemma 1

Proof. Let F_ϵ and f_ϵ be the CDF and density function of ϵ_i, respectively. Consider $0 \neq d \in I$,

$$\begin{aligned} F(d) &= \Pr(\epsilon_1 - \epsilon_2 \leq d) \\ &= \int_{\underline{I}}^{\overline{I}-d} F_\epsilon(d+r) f_\epsilon(r) dr + \int_{\overline{I}-d}^{\overline{I}} f_\epsilon(r) dr \\ &= \int_{\underline{I}}^{\overline{I}-d} F_\epsilon(d+r) f_\epsilon(r) dr + 1 - F_\epsilon(\overline{I}-d), \end{aligned}$$

and we can differentiate $F(d)$ to get

$$\begin{aligned} f(d) &= (-1) \cdot F_\epsilon(d + \overline{I} - d) f_\epsilon(\overline{I} - d) + \int_{\underline{I}}^{\overline{I}-d} f_\epsilon(d+r) f_\epsilon(r) dr + f_\epsilon(\overline{I} - d) \\ &= \int_{\underline{I}}^{\overline{I}-d} f_\epsilon(d+r) f_\epsilon(r) dr. \end{aligned}$$

Let us now extend $f_\epsilon(d+r)$ for every $r \in I$ through the following function

$$f_\epsilon^*(d+r) = \begin{cases} f_\epsilon(d+r), & \text{for } \underline{I} \leq r \leq \overline{I} - d, \\ f_\epsilon(d + r - \overline{I} + \underline{I}), & \text{for } \overline{I} - d < r \leq \overline{I}, \end{cases}$$

which implies that

$$f(d) = \int_{\underline{I}}^{\overline{I}-d} f_\epsilon(d+r) f_\epsilon(r) dr < \int_I f_\epsilon^*(d+r) f_\epsilon(r) dr.$$

Note that f_ϵ^* is a simple transformation of f_ϵ through its argument.

We will now prove that $f(0) = \int_I f_\epsilon^*(0+r) f_\epsilon(r) dr = \int_I [f_\epsilon(r)]^2 dr > f(d)$. Formally,

$$\int_I [f_\epsilon(r) - f_\epsilon^*(d+r)]^2 dr \geq 0$$

which suggests that

$$\int_I [f_\epsilon(r)]^2 dr + \int_I [f_\epsilon^*(d+r)]^2 dr \geq 2 \int_I f_\epsilon(r) f_\epsilon^*(d+r) dr,$$

and using the fact that $\int_I [f_\epsilon(r)]^2 dr = \int_I [f_\epsilon^*(d+r)]^2 dr$, we get

$$2f(0) = 2\int_I [f_\epsilon(r)]^2 dr = \int_I [f_\epsilon(r)]^2 dr + \int_I [f_\epsilon^*(d+r)]^2 dr \geq 2\int_I f_\epsilon(r) f_\epsilon^*(d+r) dr > 2f(d),$$

for every $d \neq 0$, as stated. □