# 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 contests' stakes, by extending opportunities for policy implementation or private gain upon winning, and enhancing incumbent advantage. A model of political contests with endogenous sabotage indicates that higher stakes 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 significant adverse effects, and reduces social welfare.[3]

Our study examines the impact of resource windfalls on political sabotage, 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 competitions' conditions, and the winning payoffs. 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.

[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 (2020); 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)).

We consider this hypothesis via the case of resource windfalls. The latter represent a major, plausibly exogenous, source of income for economies endowed with natural resources (Arezki et al., 2017). On the one hand, they induce economic development at the local level (Cust and Poelhekke, 2015), also within the short-term, thus potentially enhancing incumbents' advantage in the political contest (e.g., Matsen et al. (2016)), in addition to improving the economic state at which winning candidates commence tenure. On the other hand, they increase corruption and the potential for (incoming) incumbents' private gain (Caselli and Michaels (2013); James and Rivera, 2022). Put together, resource windfalls may increase contests' stakes, hence possibly affecting the behavior of political candidates, including the extent of sabotage.[4]

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 endogenous sabotage. The model considers a (initially symmetric) campaign game of two players who compete over public support via either a positive campaign that glorifies 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 exogenous shock, candidates' incentives become more pronounced, leading them to incur higher costs in their campaign efforts. Under standard cost structures with diminishing, lower returns from positive campaigns,[5] 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.[6]

In addition, we consider asymmetric settings. In case one of the candidates is in a leading position, for instance via an incumbent advantage (Falk and Shelton, 2018), 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 (resource-induced) payoff-increasing shock, which may exacerbate incumbents' advantage via, for example, potential Petro-Populism (Matsen et al., 2016).

The model's predictions are corroborated by the empirical analysis. We undertake an em-

[4]In addition, resource windfalls may affect voters' incentives (to which candidates possibly react); however, as we later discuss, and illustrate empirically, potential impacts on voters' political polarization, political donations, or turnout rate, do not explain the observed patterns.

[5]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).

[6]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 an exogenous payoff increase.

pirical 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 candidates' payoffs. Importantly, U.S. state governments are fiscally autonomous, and benefit from the natural resources located in their territories.[7] 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), and extend it to 2020 under monthly frequency. 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 the monthly average international price of crude oil. 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 a binary Ad Tone Index, which outlines whether an ad bears a non-negative tone (promoting a candidate, or contrasting a candidate with an opponent), or rather a negative one (attacking 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,

[7] 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.

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 daily-level data 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 unit of analysis is at the ad level, covering about 5.2 million ads, which are matched with the noted state-by-month resource windfalls. Adopting a monthly-based framework, we account for the pre-recorded nature of TV political ads, assuming they react to candidates' incentives within this time-frame, which in turn enables examining the patterns of tone characteristics across as well as within election races. 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 contemporaneous impact of monthly-level 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 start with a preliminary analysis, which examines various initial facets of our hypothesis, following three different methodologies. First, we present an anecdotal examination of the case of Alaska. Second, we undertake an event study analysis which focuses on major changes in the oil price. Last, we consider a Regression-Discontinuity (RD) design, by exploiting the quasi-experimental case of COVID-19, vis-à-vis its impact on the oil price in 2020. The results of these initial examinations provide support for the hypothesized windfall-sabotage nexus, motivating undertaking more rigorous examinations, which we do thereafter, in the main analysis. 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.

We test 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, most notably when candidates are non-incumbents, parties are institutionally weak, and election races are competitive. In addition, we find that a corrupt environment enhances the impact of windfalls on negativity. These outcomes suggest that the main effect is triggered by resource-induced changes in winning payoffs (specifically, those related to corruption) rather than by enhanced incumbents' advantage, as the latter is mostly applicable under asymmetric settings in which one of the candidates is an incumbent. Last, we show that the windfall-negativity nexus is not driven by potential impacts on political polarization, political donations, or voter turnout and apathy, thus motivating the focus in the analytical framework on changes in candidates' incentives rather than voters' preferences.

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 facets of 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), increase the extent of political donations (Sances and You (2022)), 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, potentially manifested by resources. Empirically, we unravel a significant and robust positive impact of resource windfalls on the extent political sabotage, vis-à-vis the case of negative campaigning in U.S. gubernatorial elections, and show that it is not driven by potential changes in voters' preferences (observed via political polarization, political donations, and voter turnout), thus supporting the focus on candidates' incentives adopted in the analytical framework.

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 also applicable in asymmetric settings, in which one of the candidates has a structural or resource-driven (incumbent) advantage, yet is nonetheless stronger in symmetric settings.

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 (2023), 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 $\epsilon_i$ 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*. This accounts for the theoretical impact of resource windfalls on the conditions upon winning. Upon election, 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. Resource windfalls, however, may also be exploited by incumbents to gain further support in the competition (via populist actions, for instance). To consider 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). In general, the payoff $r$ encompasses several attributes, including a fixed baseline component for winning, a stochastic component for resource windfalls, and potentially some impact on voter behavior. To simplify the exposition, we assume for now that $r$ is fixed and strictly positive, and provide a broader discussion on this issue in Subsection 3.3.

#### 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.[8]

[8]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.

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 $s_i^{\beta}$ is effectively bounded from above by 1.

Finally, 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 $\epsilon_1$ and $\epsilon_2$ is sufficiently large (similarly to Lazear (1989); see footnote 3 therein).

## 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

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

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

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

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

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 players are symmetric, i.e., $v_1 = v_2$. Given that a pure-strategy NE exists, the following proposition states that it is also symmetric and unique, while describing it *implicitly* in Equations (2) and (3) below. These two equations, derived from the previously stated FOCs under a symmetric NE, along with the fact that $c'(\cdot)$ is strictly increasing (due to convexity), show that both effort levels $e_i$ and $s_i$ are *jointly* increasing in the reward $r$.[9] Following this proposition, we proceed to deduce three additional conclusions regarding the evolution of positive and negative campaigns, in equilibrium, and illustrate this result in Figure 1.

**Proposition 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 additional conclusions that we can derive from Proposition 1. First, by combining the implicit equilibrium conditions provided in Equations (2) and (3), we obtain 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 $v$. Second, the fact that $\frac{1-\alpha}{1-\beta} > 1$ (or, equivalently, $\beta > \alpha$) implies that negative-campaign efforts exhibit convexly increasing behavior as a function of the positive ones. 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. One can see this in Equations (2) and (3), as $r$ increase

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 $c(e_i + s_i) = (e_i + s_i)^2$, a baseline reputation of $v = 1$, and $(\alpha, \beta) = (0.5, 0.75)$. One can see that a higher reward $r$ (for example, when $x$ increases from 1 to 1.5) leads to higher effort levels, both positive and

[9] Any upward shift in $r$ increases the RHS of Equations (2) and (3), so that both effort levels $e_i$ and $s_i$ must increase to adjust the LHS accordingly.

negatives ones. However, above the equality level where $e_i = s_i$ (see dotted line in Figure 1), this also leads to a relatively more negative campaign given the symmetric equilibrium in Proposition 1, as the negative effort level increases faster. The intuition for this result hinges on the superior marginal impact of the negative campaign captured by the condition $\beta > \alpha$.

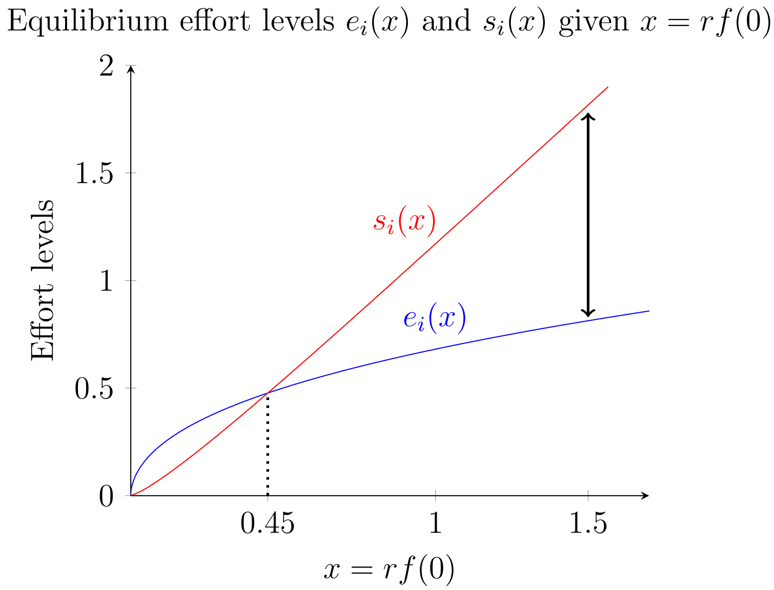


Figure 1: The graph illustrates the players' effort levels, $e_i$ (blue) and $s_i$ (red), as a function of $x = rf(0)$, under the symmetric equilibrium described in Proposition 1. It is based on the quadratic cost function $c(t) = t^2$, the parameters $(\alpha, \beta) = (0.5, 0.75)$ and a baseline reputation of $v_1 = v_2 = 1$. As the reward $r$ (representing the windfall) increases, both efforts levels jointly and monotonically increase as well. However, above the equality level of $x = 0.45$, the negative (campaign) effort level increases faster such that the two effort levels diverge from one another (see two-sided arrow at $x = 1.5$). This follows from the difference in the marginal impact of every campaign channel, captured by the condition $\beta > \alpha$.

## 3.2 The asymmetric setup

Now, let us examine a setting in which players are not ex-ante symmetric. There are two primary dimensions of asymmetry in our framework: costs/rewards and reputation. The effects of asymmetric costs/rewards are somewhat straightforward, as they enable players to exert higher levels of effort, both positively and negatively. So, significantly superior financial conditions for one player can lead to dominance across all campaign channels. This financial advantage would also likely enhance the player's baseline reputation relative to the other player.[10] For these reasons, we focus our analysis on the less obvious aspect of asymmetry—the players' baseline

[10]Note that in Section 3.3, we discuss the potential *symmetric or asymmetric impact* of $r$ on the players' costs, as examined in, for example, James and Rivera (2022) and Sances and You (2022).

reputation levels. 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, thus, allows us to analyze the utilization of different campaign channels in relation to the baseline reputation levels. The following proposition shows that Equations (2) and (3) partially extend to the asymmetric scenario where $v_1 > v_2$, as implicitly depicted in Equations (4) and (5) below. Given that a pure-strategy NE exists, the functional relation between the positive and negative effort levels from Proposition 1 remains valid and presented in Equation (6). Moreover, Proposition 2 also reveals that the "stronger" player 1 (in terms of the baseline reputation such that $v_1 > v_2$) tends to employ a more positive campaign strategy and a less negative one, compared to the "weaker" player 2 (i.e., $e_1 > e_2$ and $s_2 > s_1$).

**Proposition 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:*

$$e_i^{1-\alpha} c'(e_i + s_i) = \alpha r f(d_{a_1,a_2}), \tag{4}$$

$$s_i^{1-\beta} c'(e_i + s_i) = v_{-i} \beta r f(d_{a_1,a_2}) \tag{5}$$

$$\text{where } d_{a_1,a_2} = v_1 - v_2 + e_1^\alpha + v_2 s_1^\beta - e_2^\alpha - v_1 s_2^\beta,$$

$$s_i^{1-\beta} = \left[\frac{v_{-i}\beta}{\alpha}\right] e_i^{1-\alpha} \tag{6}$$

$$e_1 > e_2 \text{ and } s_2 > s_1.$$

Several noteworthy conclusions can be drawn from Proposition 2. First, as in Skaperdas and Grofman (1995), 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 Proposition 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 due to 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.[11] 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 $s_i$ increase (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 Propositions 1 and 2 all effort levels depend on $rf(d_{a_1,a_2})$ as given in the RHS of Equations (2)–(5), where $d_{a_1,a_2} = 0$ in the symmetric case. The subsequent lemma states that $d = 0$ is a global maximum of $f$. This implies that the impact of the reward in the symmetric framework, captured by the term $rf(0)$ in the RHS of Equations (2) and (3), is greater than in the asymmetric one, captured by $rf(d_{a_1,a_2})$ in the RHS of Equations (4) and (5). In other words, the impact of the reward $r$ on the candidates' effort levels in equilibrium depends on the (scale) parameter $f(d_{a_1,a_2})$, which reaches its maximum value in the symmetric case, where $d_{a_1,a_2} = 0$.

**Lemma 1.** *Let $\epsilon_1$ and $\epsilon_2$ 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 Propositions 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 Proposition 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 $f$.

[11] It is 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.

### 3.3 The payoff value $r$

Our comparative statics analysis studies the candidates' effort levels, in equilibrium, as a function of the payoff value $r$. However, the payoff value is itself a non-trivial component in the candidates' utility functions. The parameter $r$ captures all payoff-relevant values associated with winning the competition. It can be decomposed into two parts: a fixed, strictly positive value from being in office, denoted by $R_0 > 0$,[12] and a non-negative stochastic component, $R \geq 0$. The stochastic component reflects the candidate's potential additional gains from resource windfalls, which as noted may arise, for instance, from increased fiscal space to implement preferred policies or through windfall-related corruption. So, even in the absence of resource windfalls, candidates still benefit from being elected. Note that this structure has no impact on our analysis, because the expected payoff of a winning candidate translates $R_0 + R$ into $r \equiv \mathbf{E}[R_0 + R] > 0$, where $\mathbf{E}(\cdot)$ is the expectation operator.

The stochastic value $R$, based on resource windfalls, can also relate to additional components in the candidates' utility functions: (i) the cost function; and (ii) voter behavior. In addition, the impact on each of these components could be either symmetric, or asymmetric. Let us relate to each of these possibilities separately.

Starting with the cost function, one should consider the impact of resource windfalls on the candidates' cost functions due to their ability to raise additional donations (see, e.g., James and Rivera (2022) and Sances and You, 2022). Thus, an expected increase in $r$ should typically lead to lower costs. Our analysis already accounts for this possibility, given the additive structure of the utility functions. As is customary in contest theory, the cost function can be normalized so that costs are measured relative to the payoff value $r$. In other words, an increase in $r$ effectively reduces the candidates' relative costs (i.e., in proportion to the expected payoff), which ultimately leads to both absolute and relative increases in sabotage levels.[13]

Moreover, even if the impact of $r$ on the cost functions is asymmetric,[14] Equations (4) and (5), and most importantly, Equation (6), still hold under the updated cost functions. Namely, the condition $s_i^{1-\beta} = \left[\frac{v_{-i}\beta}{\alpha}\right] e_i^{1-\alpha}$ (used to establish our key findings) remains valid, even if the impact of $r$ on the two cost functions differs, and the augmented sabotage result still applies.

Moving on to the second aspect, an increase in $r$ may also affect voter behavior, such as electoral support, turnout rates, and public opinion, which may in turn influence candidates' decisions. For example, $r$ may increase electoral support if voters attribute the positive shock

[12] Reminiscent of the *ego rent* component in Maskin and Tirole (2019).

[13] In addition, in Section 4, we directly examine the role of political donations within the empirical analysis, illustrating that they do not affect the main results.

[14] For example, if the cost function of the "stronger" player 1 in Proposition 2 is strictly lower than the cost function of "weaker" player 2, or vice versa.

to the incumbent (as in Wolfers, 2002). If $r$ impacts the players' underlying reputation levels, then Equations (4), (5), and (6) still hold, given the updated reputation levels.

Moreover, the relation $s_i^{1-\beta} = \left[\frac{v_{-i}\beta}{\alpha}\right] e_i^{1-\alpha}$ implies that the sabotage level $s_2$ of the non-incumbent (the "weaker") player 2 increases with the incumbent's baseline reputation $v_1$. Thus, if the incumbent's baseline reputation increases more than that of the non-incumbent due to resource windfalls (as in Wolfers, 2002), then, all other things being equal, this only strengthens our results by increasing the non-incumbent's negative campaign efforts.

Additionally, resource windfalls may also trigger voter polarization, as demonstrated by Ikan et al. (2024), or impact electoral participation either way (Andersen et al. (2014) find a positive effect, whereas Sances and You (2022) find a negative one). Yet, under the previously stated assumptions, neither of these channels affects our theoretical analysis, which shows that resource windfalls boost candidates' campaign efforts aimed at swaying voters either way. In the next section, we also provide empirical support for these conclusions through the cases of political polarization and voter turnout rates.

## 3.4 Impact on social welfare

Before we proceed to the empirical findings, we wish to discuss several general aspects concerning the potential impact of intensified negative campaigning on social welfare. The results presented in Propositions 1 and 2 illustrate a clear connection between the candidates' baseline reputations $(v_1, v_2)$ and the levels of negative campaigning $(s_1, s_2)$. This dependence is given in Equation (6), which states that $s_i^{1-\beta} = \left[\frac{v_{-i}\beta}{\alpha}\right] e_i^{1-\alpha}$. Thus, a candidate with a higher baseline reputation will be subjected to higher levels of negative campaigning, in addition to the amplified impact of $r$, namely resource windfalls. Though this goes beyond the focus of the current study and model, one can still see how this could lead to adverse selection of candidates (as in Münster (2007)). For example, while resource windfalls increase the expected payoff, a potential candidate with better attributes, correlated with a higher baseline reputation, might be deterred from the electoral competition due to the heightened negative impact on their personal reputation. This, of course, may depend on the candidate's outside option, which naturally improves with their type.

Another aspect of social welfare is the indirect impact of negative campaigning on policy and productivity (as in, e.g., Carpenter et al. (2010); Gürtler et al. (2013); Deutscher et al. (2013)). Our analysis shows that resource windfalls increase the share of negative campaigning relative to positive campaigning. A clear illustration of this is given in Figure 1, where an increase in $r$ leads to diverging effort levels between the positive and negative channels.

One plausible interpretation is that candidates become less focused on constructive ideas and policies, opting instead to undermine their competitors, which ultimately leads to poor policies in practice. In political contexts, previous studies have shown that high levels of sabotage eventually erode trust in democratic processes and government (Lau et al. (2007)) as well as institutional legitimacy (Gibson (2008)).

### 3.5 Testable hypotheses

To summarize, our related key theoretical findings concerning the impact of changes in candidates' payoffs on the extent of sabotage point at two main testable hypotheses:

- An increase (decrease) in candidates' payoffs increases (decreases) their relative investments in political sabotage.
- The impact of candidates' payoffs on political sabotage is more pronounced in symmetric environments.

In Section 4, we examine these predictions empirically.

## 4 Empirical Analysis

The model above explains how the extent of sabotage in political contests may rise with an increase in the 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 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 various facets of the contest, including the state at which candidates commence tenure, the advantage of incumbents, and voters' behavior. 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). Resource-triggered economic booms within election years may, therefore, represent potential electoral payoffs for winning candidates by extending their ability to implement desired policies, or extract private gain, upon winning.[15] In addition, they may provide further advantage to incumbents over the course of their campaign, as they can be exploited for populist endeavors (Matsen et al., 2016).[16] Last, they may alter voters' behavior, including participation (Andersen et al. (2014), Sances and You, 2022), campaign donations (James and Rivera (2022), Sances and You, 2022), and polarization (Ikan et al., 2024). 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,[17] 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 conditions and winning payoffs (resource windfalls) together with political incentives during campaigns, as hypothesized in the theoretical framework. Fourth, gubernatorial elections are largely bi-partisan, 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 running from resource booms to the extent of negative political campaigns. Next, we describe the data and methodology in more detail.

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

[16] As Falk and Shelton (2018) point, reelection-seeking incumbents have a large electoral advantage due to various reasons, including for instance name recognition or free press, and are reelected at relatively high rate.

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

## 4.1 Data and methodology

We examine daily-level data of TV political ads related to the U.S. gubernatorial elections, across the 48 contiguous states, covering the period 2010-2020.[18] 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 a variant of the measure constructed in James (2015), which we extend to 2020 in monthly frequency. This measure is based on the interaction of two plausibly exogenous variables. The first is the cross-sectional (time-invariant) difference in geologically-based recoverable stocks of crude oil.[19] This data is derived from the U.S. Geological Survey at the province level, which James (2015) aggregates to the state level.[20] The second is the average international price of crude oil, at a monthly frequency. Their interaction provides the monthly-level average state resource endowment, which is then normalized by states' land area.[21]

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 oil-based resource windfalls across states as well as within them. Second, it provides ample cross-state variation; specifically, given the usage of recoverable stocks, only 10 states have zero natural endowments (and hence no windfalls throughout the sample period).[22] The average natural endowment ranges from none (e.g., DE) to slightly above 2 (TX), in million USD per 100 square kilometers, with a mean of 0.33 and a standard deviation of 0.41. This is illustrated in Figure 2, which plots the average level of this measure across the 48 continental U.S. states.

Third, this vast cross-state variation in this measure enables testing the impact of natural

[18]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.

[19]We also examine separately the natural-gas-based equivalent, to consider the role of different types of resources. For the baseline analysis, however, we focus on the case of crude oil as it represents the primary source of resource windfalls.

[20]The survey was taken in the mid-1990s, hence being predetermined to the sample period we consider. In addition, AK and HI are not included in the survey. Restricting, together with the corruption measure, the sample to the 48 continental states.

[21]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.

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

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)). Last, despite being geologically-based, this measure is highly correlated with changes in oil production and revenues, as illustrated by James (2015), thus translating to windfalls.[23]

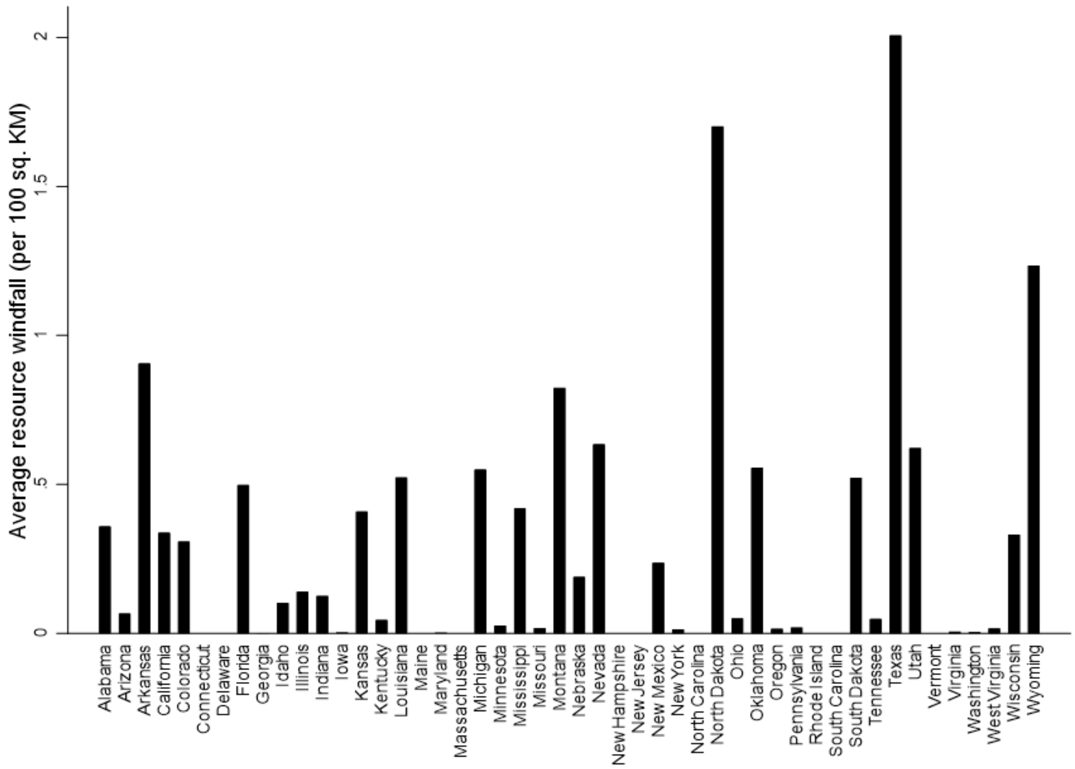


Figure 2: The figure presents the average resource windfall (in $ million) per 100 square kilometers across the 48 continental U.S. states over the period 2010–2020.

### 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 coverage is annual, with various states participating in each cycle, depending on whether gubernatorial elections are undertaken there in the

[23]The correlation with oil revenues indicates that changes in oil prices, captured via the measure's temporal dimension, translate to variations in windfalls in resource-rich states. In these states, a significant increase in the price of oil yields large inflows of income, whereas an unexpected steep drop in the price induces a corresponding drop in the expected stream of income, thus providing variations in windfalls.

given year.[24] Importantly, the focus is strictly on the (largely 2-player) gubernatorial contest; hence, primaries are excluded. In addition, ads are aired within the markets relevant to the target audience; i.e., within the state corresponding to the race the ad refers to (despite being categorized under a geographically broader media market). 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;[25] over the sample period, 2010-2020, the baseline sample covers close to 5.2 million ads. For each advertisement 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,[26] 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 constructing a binary Ad Tone Index that takes the values 0-1, as follows: 0 non-negative tone (promote or contrast), 1 negative tone (attack).

We, thus, adopt a 2-level index, in which positive and contrasting ads are grouped together, to form a non-negative classification. Therefore, the index is increasing in the negative tone, where a change from 0 to 1 represents a movement from non-negative to negative.[27] 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

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

[25] As will be evident, this in turn means that each observation is at the ad-by-date level (where date refers to a specific day, within the overall noted sample period).

[26] The terms ‘candidate’, or ‘preferred candidate’, employed throughout the analysis, refer to the ad’s beneficiary.

[27] Nonetheless, later in the analysis we also examine a 3-level index that considers a contrasting tone as a separate, intermediate negativity level, illustrating that the main outcome is robust to this change.

level is 0.34, with a standard deviation of 0.47, and while in states like TN or UT it is less than 0.1, in others like IL and WI, the average is around 0.5. We study the patterns of this measure, focusing on the impact of resource windfalls.

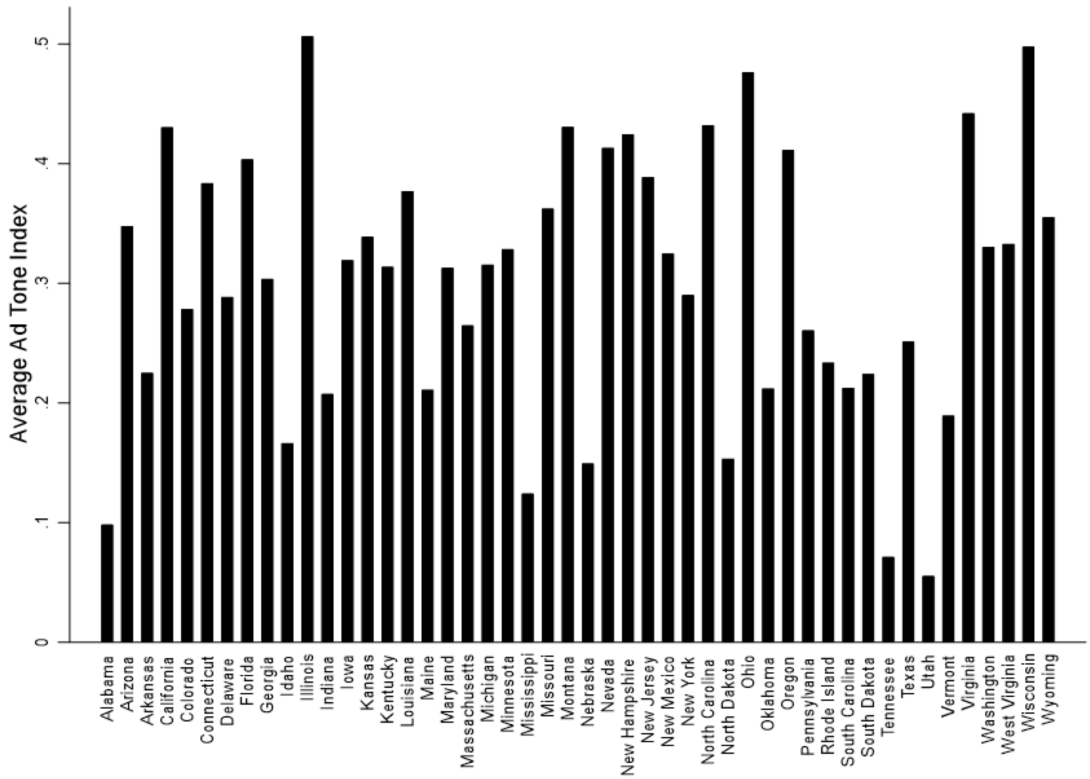


Figure 3: The figure presents the average Ad Tone Index across the 48 continental U.S. states over the period 2010–2020.

### 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 days (specific dates in which ads were aired), 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 $i$, date $t$, month $m$, and year $y$:[28]

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

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,[29] and $\eta$ and $\nu$ are state and date fixed effects, respectively. The latter refers to (specific) 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, this setting considers a monthly time perspective. Given that TV-based political campaigns are largely pre-recorded, we assume that campaigns are reactive within a monthly time-frame. Hence, our treatment, namely $windfall$, is considered under a monthly frequency ($m$). In effect, in terms of the temporal dimension, we examine the impact of monthly variations in windfalls on the extent of negativity. Nonetheless, to exploit the full extent of variation in the political ads data, we concurrently maintain its daily-level frequency in the baseline analysis.[30] This time perspective lets us consider detailed cross- as well as within-campaign variation (as opposed to, e.g., an annual-level treatment), while keeping the time-frame sufficiently wide so as to allow for observable changes in the tone of political campaigns.[31]

Finally, the baseline model includes state and time (date) fixed effects only. This is so given that the identifying variation of our treatment is, as noted, across these two dimensions; we seek to estimate within-state effects of resource windfalls across time. Nonetheless, we examine the role of further ad-level and additional fixed effects throughout the analysis. Our focus in the analysis is on the characteristics of $\alpha$, namely its sign, magnitude and statistical preciseness, which give an estimate for the contemporaneous impact of resource windfalls on the extent

[28]Noting that month $m$ refers to a *specific* month-year; e.g., March 2010 (rather than simply March).

[29]To clarify the related notation, if a control in $\mathbf{X}$ is at the ad level, then it varies by $a$ (ad) and $t$ (day). Otherwise, if the control is at the state level, it may vary, in addition to $i$ (state), either by $m$ (month-year), or $y$ (year).

[30]Later in the analysis, we consider a setting in which ads are aggregated at the candidate-month level, illustrating that the main results are robust to this modification.

[31]More detailed treatment time frequencies, say at weekly or daily levels, are not sufficiently large to induce changes in pre-recorded TV ads.

of campaign negativity. Throughout the analysis we adopt a conservative two-way clustering approach, in which the standard errors are clustered by states and dates (days) concurrently.

## 4.2 Preliminary analysis

As an initial step in the analysis, and in an attempt to further motivate our main analysis, we provide preliminary evidence by considering three methodologies, each providing its own, distinct perspective on the main hypothesis. The first examines anecdotal evidence vis-à-vis the case of Alaska. The second undertakes an event study analysis that looks into the impact of major increases in the international price of oil. The third employs the unique case of COVID-19 to execute a RD analysis following the consequent steep changes in the oil price in 2020.

### 4.2.1 Anecdotal evidence: The case of Alaska

As an anecdotal observation, we look into the case of Alaska. Alaska serves as an appealing case study for several reasons. First, Alaska is one of the most natural resource rich states in the U.S.,[32] hence it is potentially highly affected by changes in the international price of oil. Second, Alaska has a history of competitive gubernatorial races, often featuring a variety of candidates from different parties and independent backgrounds; its setting is, therefore, reminiscent of the symmetric set up considered in the analytical framework, in which candidates put relatively higher effort in their political campaigns, when the stakes are high. Third, not being part of the contiguous states, Alaska is relatively remote and hence is less affected by the political races of other states; e.g., unlike other states, within the contiguous U.S., Alaska has its own, distinct, media market.[33]

Our focus is on the months prior to election day (early November), in the 2010 and 2018 gubernatorial races. We adopt this focus because both the 2010 and 2018 gubernatorial races were considered competitive, with relatively strong candidates. In addition, in both cases the oil price was relatively steady throughout the campaign, yet taking a relatively steep change in the 2-3 months prior to elections when campaign efforts increase. Importantly, this steep change was in an opposite direction in each case.

Specifically, the 2010 race had Governor Sean Parnell, a Republican who eventually received 57% of the votes, and Ethan Berkowitz, a candidate of the Democratic party, who eventually received 37% percent of the votes. Throughout most of the campaign in 2010, the average (per

[32] For instance, in 2020 the share of the oil sector in Alaska's total Gross State Product was close to 20%

[33] In addition, due to data limitations, Alaska is excluded from the baseline analysis; hence, an anecdotal examination of its case complements the main analysis.

barrel) international oil price was around 110$, getting to a low of about 103$ at the end of July, and then increased to approximately 121$ by early November; i.e., a steep increase of almost 20% over the last few months of the campaign. In 2018 the competition was also relatively fierce, mainly between Republican Mike Dunleavy, and Democrat Mark Begich (incumbent Bill Walker dropped out of the race), with the votes splitting 51%, and 45%, respectively. In this case, however, the average price of an oil barrel during most of the campaign was around 85$, reaching to 91$ at the end of August, and dropping to about 63$ by early November; i.e., a steep decrease of close to 30% over the last months of the campaign.

Having two relatively intense races, with steep, yet opposite, changes in the oil price in relatively similar stages of the political campaign (i.e., a few months prior to election), enables undertaking a simple, anecdotal comparison of the extent of negative tone of the two main candidates in each race. Focusing specifically on the ads of the above-mentioned contenders, in each race, we observe that in the 2010 case the negative tone of the contenders started rising significantly in August, having an average of 0.09, and then getting up to 0.44 by the end of October; i.e., an increase of about 4.5 times in the extent of negativity. Conversely, in the 2018 case, the average negativity level was at 0.47 by the end of August, yet decreasing to 0.33 by the end of October, representing a decrease of about 30% in the extent of negative tone. These opposite patterns are consistent with those of the oil price in the two cases, albeit examining similar periods in competitive races, pointing at potential co-movements with the oil price, and hence motivating a deeper examination of the given hypothesis.

#### 4.2.2 Event study analysis

Next, we analyze the impacts of significant resource windfalls within an event study analysis framework. Such a framework enables focusing on the major shocks, and examining carefully the relative effects across the cross-sectional differences in resource endowments, and over time. To do so, we follow a methodology reminiscent of the one adopted in Serrato and Zidar (2018), and estimate the following model using the data described above:

$$tone_{a,i,t} = \varphi + \sum_{k \in [-4,3]} \beta^k (D * R)_{i,m-k} + \nu_t + \eta_i + \epsilon_{a,i,t}. \tag{8}$$

In terms of notation, $tone$ and the subscripts $a$, $i$, $t$, and $m$ follow the definitions outlined in Equation (7). Additional notations include $k$, $R$, and $D$. $k$ represents a monthly-level counter. $R$ denotes the cross-sectional component of $windfall$, noted in Equation (7), representing the time-invariant cross-state differences in crude oil reserves. $D$ is an indicator for an event. We define an event to be an increase in the international price of oil of at least 10% relative to the precedent month.[34] This definition yields 11 events throughout our sample period.[35] Our focus is on the $\beta$s, which give an estimate for the impacts on the extent of negative tone in the three months prior and four months past a major increase in the oil price, across state resource endowment levels.[36] This time-frame roughly corresponds to a cycle of political campaign.[37]

The results, together with their 95% confidence intervals, appear in Figure 4. The observed patterns point at a common-trend (between resource rich and poor states) prior to an event, which changes once an event takes place. Specifically, once an event occurs the extent of negative tone in races of resource endowed states increases, relative to that in poorly endowed states. This differential effect lasts over the following three months, and wears out in the fourth month. Notably, these patterns provide initial affirmation for our main hypothesis, pointing at a positive impact of resource on the extent of sabotage. Next, we further examine this via the case of COVID-19.

#### 4.2.3 RD analysis: The case of COVID-19

Finally, we adopt the case of COVID-19 for examining an additional preliminary facet of the potential windfalls-sabotage nexus. COVID-19 provides a quasi-experimental setting via its dramatic impact on the oil prices during the 2020 gubernatorial race. In the early months of the race (Dec. 2019 to Apr. 2020), as lock-downs took place, the oil price sharply decreased, from approximately 60$ to about 20$ per barrel. Conversely, in the later months of the race (Apr. 2020 to Nov. 2020) economies began to reopen and the oil price experienced a sharp increase, reaching levels higher than 40$ per barrel. These oil price patterns are illustrated in Panel A of Figure 5.

Having steep and opposite changes in the oil price, due to a plausibly exogenous event, within the same race, enables undertaking a preliminary examination of our main hypothesis via the lens of a sharp RD design, in which the running variable is the monthly distance from

[34] We focus on (major) price increases in the event study analysis for consistency with the main analysis which considers positive windfalls.

[35] These include September 2010, March and October 2011, April 2015, March and April 2016, June 2018, December 2019, and May, June, and November 2020.

[36] In effect, $k$ starts at $-4$ and increases up to 3, giving the impact 3 months prior to an event, and up to 4 months past it. This is because once $k$ is $-4$ we examine the impact of an event 4 months prior to time $m$, which in turn provides an estimate for its impact 4 months past its occurrence. Our reference point is time $m$; this reference point is also the one adopted in Figure 4.

[37] Nonetheless, the estimates provide a cross-race average given that in certain cases an event takes place within one election race, whereas its impact spills-over to the next. I.e., a major price increase in November may have an impact that lasts over the initial parts of the following election race.

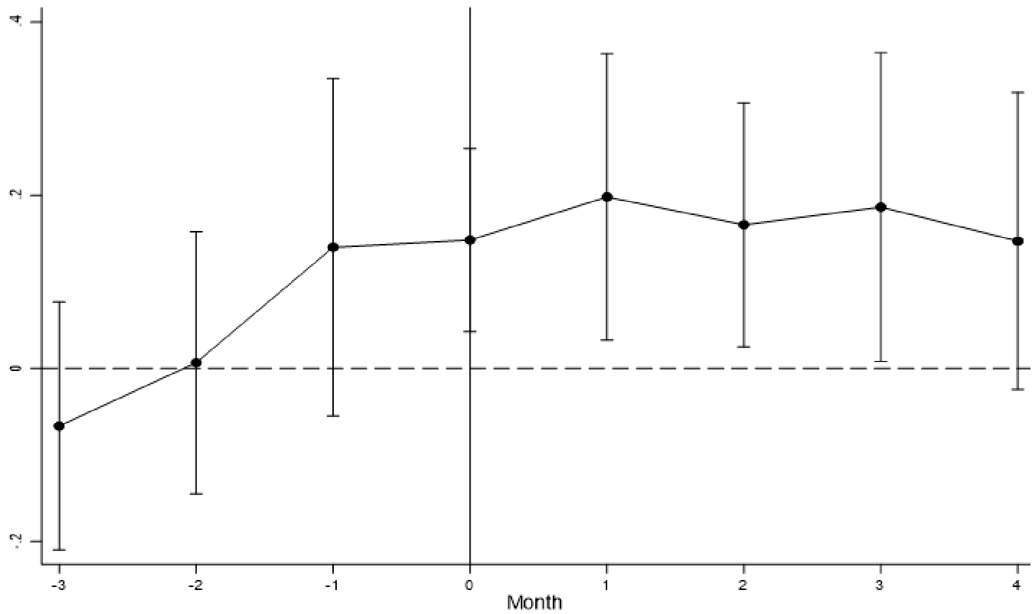


Figure 4: The figure presents the impact of major increases (>10%) in the international price of oil (relative to the precedent month), interacted with the baseline cross-sectional measure of recoverable stocks of crude oil, on the extent of negativity in political campaigns (Ad Tone Index), in the three months prior and four months past the price change. In addition, it also presents the 95% confidence intervals of each estimate. The sample includes TV political ads related to state gubernatorial elections in the 48 continental states, covering the period 2010-2020.

April 2020. The latter represents the period in which the sharp price change occurred, as observed in Panel A of Figure 5.

To do so, we follow the standard local linear approach, reminiscent of the one adopted in He et al. (2020). Our focus is on visualizing the effects, undertaken via separate RD-plots for the cases of states with positive resource endowments, and those with none, appearing in Panels B and C of Figure 5 respectively.[38] Each panel plots the Ad Tone Index against the monthly distance from April 2020, with fitted lines in the pre- and post-April cases. Each dot in these plots represents the average Ad Tone Index for states within the bin of distance, absorbing state and day fixed effects, together with 95% confidence intervals.

Considering the case of positive resource endowments, Panel B indicates that the Ad Tone Index co-moves with the oil price. Specifically, it decreases up to April 2020, at which point it switches to increasing up to election time, exhibiting an overall pattern similar to that observed by the oil price. On the other hand, no systematic connection is observed in the case of no

[38]The list of states that have an election race in 2020 appear in the Appendix; within this group, the following states have no resource windfalls: DE, NC, NH, NJ, and VT.

resource endowments, as presented in Panel C.[39] These results support the main hypothesis. Nonetheless, they are specific to 2020, and may be affected by omitted variables. Together with the previously noted preliminary findings, they motivate undertaking a rigorous analysis, which we consider next.

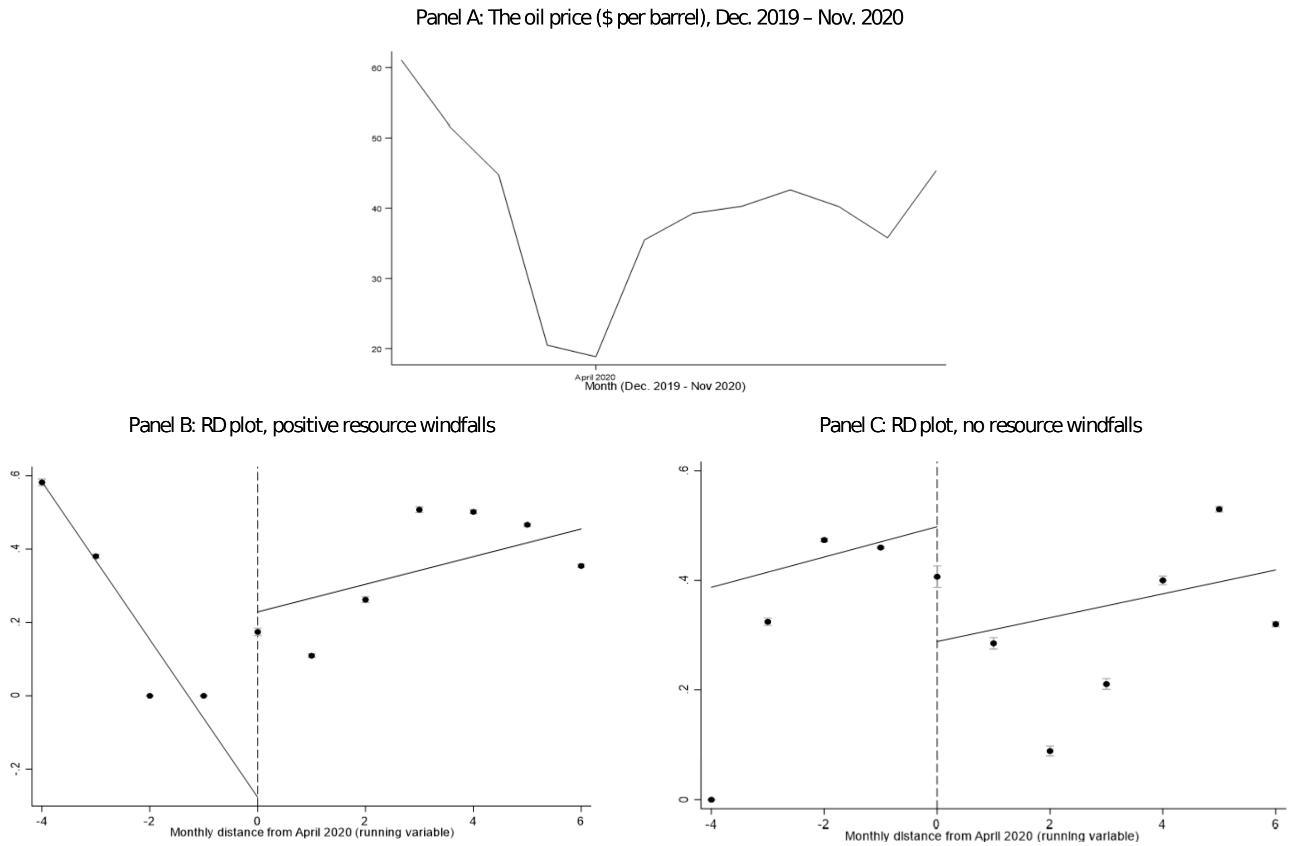


Figure 5: The figure presents the monthly average international oil price ($ per barrel), Dec. 2019 to Nov. 2020, in Panel A. Panels B and C present RD plots, for the case of states with positive, and zero, resource windfalls respectively, over the 2020 election race period (Dec. 2019 to Oct. 2020), with April 2020 representing the discontinuity. The group of states with no (positive) windfalls includes DE, NC, NH, NJ, and VT (remaining states with election races in 2020, as outlined in the Appendix). Each of the panels B and C plots the Ad Tone Index against the monthly distance from April 2020 (running variable), absorbing state and day fixed effects. Each dot represents the average Ad Tone Index for states within a bin of distance, together with its 95% confidence interval.

[39] A quantification of the graphical findings, via RD robust and bias-corrected estimates at the discontinuity, following the procedure developed in Calonico et al. (2019), support the observed patterns. Specifically, Panel B yields a positive and statistically precise estimate (0.22), whereas Panel C produces a negative and statistically imprecise estimate with a smaller magnitude (-0.12).

## 4.3 Main analysis

This Subsection outlines the main empirical analysis and results. We start with the baseline main results, and continue to additional examinations and robustness tests thereafter.

### 4.3.1 Resource windfalls and negative political campaigns

Motivated by the preliminary findings, 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 **X** excluded. The results provide support for our main hypothesis. Consistent with the main prediction of the model, we notice that $\alpha$ 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 an oil-driven windfall, 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 $\alpha$ indicates that a one standard deviation increase in resource windfalls increases the average negative tone of political ads by about 10%.[40]

Consistent with the theory, the estimated main effect ($\alpha$) suggests that the sign of the treatment may affect the direction of the impact.[41] Notably, this was also suggested by the results of the RD analysis and the case of Alaska described previously, which pointed at co-movements with the oil price. To examine potential symmetric effects more directly, in Column 2 we consider the impact of increases and decreases in the oil price. Specifically, we include two measures in lieu of $windfall$. The first (second) is a binary indicator that captures the cases in which the oil price increased (decreased) relative to the precedent month, multiplied by the absolute-value change in the oil price from the precedent month, and the cross-sectional component of the $windfall$ measure. In effect, these measures capture, separately, the cases in which there are positive and negative windfalls, accounting for the magnitude, via the extent of change in the oil price and the cross-state difference in the impact. Considering both measures concurrently, the estimates in Column 2 point at the role of the windfall direction. In case of positive (negative) windfalls, the extent of negativity rises (drops). Interestingly, the magnitudes (in absolute terms) suggest that positive windfalls are relatively more impactful.

The next columns include **X**; each case addresses a different facet of ad patterns. In Column 3 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

[40] A one standard deviation of windfall, 0.4, multiplied by the estimated $\alpha$, 0.11, is 0.04, which is approximately 10% of the mean Ad Tone Index, 0.35.

[41] In effect, we examine different levels of non-negative windfalls. Nonetheless, the estimated $\alpha$ indicates that, in principle, a negative windfall would *decrease* the extent of negativity.

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.[42] Second, the economic situation. Endogenous economic changes have been shown to induce electoral and political impacts in election years (e.g., Brender and Drazen, 2008; Paltzman, 1992), hence we include states' per capita Gross State Product (GSP). Third, corruption level. A corrupt environment provides more concrete reasons for attacking political candidates, and more opportunities for private gains.[43] Therefore, we include standard 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.[44] 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.[45]

The results in Column 3 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 the impact of endogenously-driven economic booms is consistent with a view that voters are informed (e.g., Brender and Drazen, 2008), enhancing candidate asymmetry and thus reducing negativity.[46] Importantly, $\alpha$ retains its sign and preciseness, with a relatively

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

[43]Consistent with the literature (e.g., Raveh and Tsur, 2023), we define corruption as "criminal abuses of public trust by government officials".

[44]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).

[45]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.

[46]Informed voters may attribute endogenous economic shocks to incumbents, increasing incumbents' support, and hence enhancing asymmetry in the contest.

Table 1: Resource windfalls and negative political campaigns

| Dependent variable: Ad Tone Index | (1) Baseline | (2) Increases VS decreases | (3) Politico-economic factors | (4) Candidate features | (5) Ad characteristics | (6) Sectoral composition |
|---|---|---|---|---|---|---|
| Resource windfall | 0.11*** | | 0.17*** | 0.18*** | 0.09*** | 0.08*** |
| | (0.017) | | (0.03) | (0.05) | (0.01) | (0.02) |
| Positive_price_change | | 0.18*** | | | | |
| | | (0.02) | | | | |
| Negative_price_change | | -0.1*** | | | | |
| | | (0.05) | | | | |
| GSP per capita | | | -0.03*** | | | |
| | | | (0.003) | | | |
| Corruption | | | 0.05*** | | | |
| | | | (0.008) | | | |
| Electoral competition | | | 0.03*** | | | |
| | | | (0.002) | | | |
| Candidate party | | | | 0.01*** | | |
| | | | | (0.001) | | |
| Ad sponsor | | | | 0.01*** | | |
| | | | | (0.002) | | |
| Incumbent | | | | -0.25*** | | |
| | | | | (0.009) | | |
| Ad length | | | | | -0.01*** | |
| | | | | | (0.001) | |
| Ad cost | | | | | 0.003*** | |
| | | | | | (0.001) | |
| Manufacturing | | | | | | 0.03 |
| | | | | | | (0.45) |
| Services | | | | | | -0.29** |
| | | | | | | (0.15) |
| Wholesale/retail | | | | | | 0.39 |
| | | | | | | (0.77) |
| Government | | | | | | -0.22*** |
| | | | | | | (0.04) |
| Governor fixed effects | No | No | Yes | No | No | No |
| Candidate fixed effecs | No | No | No | Yes | No | No |
| Additional fixed effects | No | No | No | No | Yes | No |
| R-squared | 0.14 | 0.15 | 0.16 | 0.68 | 0.17 | 0.14 |
| Observations | 5190461 | 4455722 | 4025499 | 3211427 | 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. 'Resource windfall' is the baseline measure of resource windfalls, namely the interaction of the (cross-sectional) state recoverable stocks of crude oil and the average, monthly-based, international price of crude oil ($ per barrel), normalized by states' land area. 'Positive_(Negative_)price_change' captures the cases of positive (negative) percent change in the average monthly oil price relative to the precedent month, multiplied by the 'Resource windfall' measure. '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.

higher magnitude, as we observe that windfalls increase sabotage also when accounting for key politico-economic features.

In Column 4 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, 2023), 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.[47] Second, we address the 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.[48] Third, we account for incumbent advantage. Previous studies note that incumbents running for reelection 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.[49]

The results in Column 4 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.[50] 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.

[47]Similar to the case of governors discussed above, some of the candidates run for election in several cycles, hence providing variation that extends the state-year level.

[48]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.

[49]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.

[50]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).

Column 5 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.[51] The results indicate that despite the host of additional ad controls, $\alpha$ retains its characteristics, in similar magnitude. Interestingly, we also observe that relatively longer ads tend to be less negative, whereas more negative ads tend to be costlier.[52]

Last, in Column 6 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 and wholesale/retail sectors are 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.

### 4.3.2 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

[51] Although ads are aired multiple times, they maintain identical *Ad Tone Index* level across all broadcasts, thus withholding the option of a within-ad analysis. Consequently, ad fixed effects are not included.

[52] 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.

(7):

$$tone_{a,i,t} = \varphi + \alpha(windfall)_{i,t} + \beta(z)_{a/i,t} + \gamma(windfall * z)_{a/i,t} + \nu_t + \eta_i + \epsilon_{a,i,t}, \tag{9}$$

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 $\alpha$, $\beta$, and $\gamma$.

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 two key potential underlying channels considered in the model. Namely, the extent of sabotage may be affected by windfalls vis-à-vis either the state of the economy or 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 and average windfalls. Conversely, under high levels of state corruption, and average windfalls, the baseline impact of windfalls on negativity almost doubles. These patterns, in turn, highlight the relative importance of corruption 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, a dominant public sector, and non-incumbent candidates, thus strengthening the baseline effects noted earlier. These results are consistent with the model's prediction concerning the intensified impact of $windfall$ in symmetric settings. The more specific result over non-incumbents further suggests that the impact of windfalls on sabotage is not manifested via their impact on incumbent advantage; interpreting this via the analytical framework, this outcome rather highlights the relative importance of the winning-payoffs channel (which arise in symmetric, non-incumbent settings). As for ad characteristics, we observe that windfalls induce further negativity when candidates are detached from sponsorship; the magnitude of $windfall$, however, is reduced, under costlier ads.

#### 4.3.3 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 and voter behavior, and have been shown to affect corruption (see, e.g.,

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 | 0.52*** | 0.3*** | 0.09*** | 0.08*** | 0.08*** | 0.09*** | 0.11*** | 0.08*** | 0.11*** |
| | (0.04) | (0.03) | (0.06) | (0.02) | (0.02) | (0.02) | (0.03) | (0.02) | (0.02) |
| GSP per capita | -0.01*** | | | | | | | | |
| | (0.001) | | | | | | | | |
| Corruption | | 0.02*** | | | | | | | |
| | | (0.004) | | | | | | | |
| Government | | | -0.19*** | | | | | | |
| | | | (0.04) | | | | | | |
| Electoral competition | | | | 0.05*** | | | | | |
| | | | | (0.01) | | | | | |
| Candidate party | | | | | 0.03*** | | | | |
| | | | | | (0.003) | | | | |
| Ad sponsor | | | | | | 0.18*** | | | |
| | | | | | | (0.002) | | | |
| Ad length | | | | | | | -0.01*** | | |
| | | | | | | | (0.0003) | | |
| Ad cost | | | | | | | | 0.004*** | |
| | | | | | | | | (0.001) | |
| Incumbent | | | | | | | | | -0.28*** |
| | | | | | | | | | (0.01) |
| Resource windfall X GSP per capita | -0.01*** | | | | | | | | |
| | (0.001) | | | | | | | | |
| Resource windfall X Corruption | | 0.07*** | | | | | | | |
| | | (0.01) | | | | | | | |
| Resource windfall X Government | | | 0.16*** | | | | | | |
| | | | (0.03) | | | | | | |
| Resource windfall X Electoral competition | | | | 0.04*** | | | | | |
| | | | | (0.003) | | | | | |
| Resource windfall X Candidate party | | | | | 0.06*** | | | | |
| | | | | | (0.006) | | | | |
| Resource windfall X Ad sponsor | | | | | | 0.05*** | | | |
| | | | | | | (0.01) | | | |
| Resource windfall X Ad length | | | | | | | -0.001 | | |
| | | | | | | | (0.001) | | |
| Resource windfall X Ad cost | | | | | | | | -0.01** | |
| | | | | | | | | (0.002) | |
| Resource windfall X Incumbent | | | | | | | | | -0.01*** |
| | | | | | | | | | (0.002) |
| R-squared | 0.14 | 0.15 | 0.14 | 0.14 | 0.15 | 0.19 | 0.14 | 0.15 | 0.17 |
| 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. 'Resource windfall' is the baseline measure of resource windfalls, namely the interaction of the (cross-sectional) state recoverable stocks of crude oil and the average, monthly-based, international price of crude oil ($ per barrel), 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.

Raveh and Tsur, 2023), and voter apathy.[53] We, hence, consider cross-sectional differences in the institutional settings that have been reported in previous research to affect states' incumbent and voter 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 (9) 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; 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; income taxes. 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, and state upper chamber size. 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, tax and spending limits, combined tax and spending committees, and gubernatorial term limits. However, two cases are notable. The first case, the existence of income taxes, indicates that the impact of windfalls is not manifested via voter apathy (i.e., when income taxes are not levied), as the main effect is apparent, while the interaction term is imprecise. The second case, party strength, illustrates that the main effect is not only reduced, but rather reversed in this case. 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.

[53] For instance, Collier and Hoeffler (2005), Herb (2005), James and Rivera (2022), and Ross (2004), among others, show that voters disengage from the political process when they are not taxed, suggesting that related institutional features may be pivotal.

Table 3: Heterogeneous institutions

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 | Income taxes |
| Resource windfall | 0.17*** | 0.06*** | 0.12*** | 0.16*** | 0.19*** | 0.13** | 0.23*** | 0.09*** | 0.09*** | 0.06*** | 0.13*** | 0.05*** | 0.1*** | 0.09*** |
| | (0.02) | (0.01) | (0.02) | (0.05) | (0.03) | (0.06) | (0.03) | (0.01) | (0.01) | (0.02) | (0.02) | (0.02) | (0.02) | (0.02) |
| ParStrength * Resource windfall | -0.38*** | | | | | | | | | | | | | |
| | (0.04) | | | | | | | | | | | | | |
| Baseline * Resource windfall | | 0.12*** | | | | | | | | | | | | |
| | | (0.01) | | | | | | | | | | | | |
| Strict * Resource windfall | | | -0.04 | | | | | | | | | | | |
| | | | (0.03) | | | | | | | | | | | |
| Biennial * Resource windfall | | | | -0.05*** | | | | | | | | | | |
| | | | | (0.01) | | | | | | | | | | |
| DebtLimit * Resource windfall | | | | | -0.16*** | | | | | | | | | |
| | | | | | (0.03) | | | | | | | | | |
| DirDem * Resource windfall | | | | | | -0.03 | | | | | | | | |
| | | | | | | (0.08) | | | | | | | | |
| LegLimit * Resource windfall | | | | | | | -0.15*** | | | | | | | |
| | | | | | | | (0.03) | | | | | | | |
| StabFund * Resource windfall | | | | | | | | 0.04*** | | | | | | |
| | | | | | | | | (0.002) | | | | | | |
| Supermajority * Resource windfall | | | | | | | | | 0.65*** | | | | | |
| | | | | | | | | | (0.06) | | | | | |
| TaxLimit * Resource windfall | | | | | | | | | | 0.09*** | | | | |
| | | | | | | | | | | (0.03) | | | | |
| Chamber * Resource windfall | | | | | | | | | | | -0.003*** | | | |
| | | | | | | | | | | | (0.0004) | | | |
| Combined * Resource windfall | | | | | | | | | | | | 0.12*** | | |
| | | | | | | | | | | | | (0.01) | | |
| Term limit * Resource windfall | | | | | | | | | | | | | 0.02*** | |
| | | | | | | | | | | | | | (0.003) | |
| Income tax * Resource windfall | | | | | | | | | | | | | | 0.04 |
| | | | | | | | | | | | | | | (0.05) |
| R-squared | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 |
| Observations | 5190461 | 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. 'Resource windfall' is the baseline measure of resource windfalls, namely the interaction of the (cross-sectional) state recoverable stocks of crude oil and the average, monthly-based, international price of crude oil ($ per barrel), 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; 'Income tax': the existence of income taxes. For further information on variables see data Appendix.

#### 4.3.4 Different measures

The baseline analysis employed specific *windfall* and *tone* measures. In this Subsection 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, in addition to mining and quarrying, and hence provides a different, yet more direct (output-based), measure of resource windfalls. The second alternative is an interaction between the consistently oil-rich states over our sample period, and the international price of oil. Since oil-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 output (in relative terms) during the sample period. As also (partially) observed in Figure 2, these states are Alaska, Arkansas, Montana, North Dakota, Nevada, Oklahoma, Texas, and Wyoming. Interacting this indicator with the international price of oil provides plausibly exogenous time variation, reminiscent of the baseline *windfall* measure. Importantly, these two alternatives enable including Alaska, a highly resource-rich state, and Hawaii which are excluded in the baseline cases. The third alternative is the natural gas equivalent of the baseline *windfall* measure; i.e., the cross-sectional geological endowments of natural gas multiplied by the monthly average international price of natural gas.

The results of each case, presented in Columns 1-3, respectively, indicate that the main result is robust to employing different resource windfall measures, and that it extends to additional types of natural resources, such as mining and quarrying, and natural gas. Notably, the magnitudes in Columns 2 and 3 further suggest that the main effect is relatively stronger in resource-rich states (consistent with the patterns observed in the preliminary analysis), and that windfalls of natural gas induce an impact which is similar in magnitude to that observed for crude oil.

Examining *tone* alternatives, we consider three measures. The first alternative is an extended, 3-level, version of the binary baseline Ad Tone Index. This version of the index exploits the full extent of the WMP tone (re)coding by considering the tone-classifications of promoting, contrasting, and attacking, as separate, and in increasing order of negativity. Specifically, this index takes the values 1-3, where 1/2/3 denotes a promoting/contrasting/attacking tone, respectively.

The second alternative is the *CMAG Tone Index*. This index is similar to the extended Ad Tone Index in its coding and interpretation of each value; however, unlike the former measure, which was (re)coded by WMP, this measure was coded by Kantar Media / CMAG, based on their own subjective interpretations. 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.

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 | Extended Ad Tone Index | CMAG tone index | Target Indicator |
| Mining per capita | 0.03*** | | | | | |
| | (0.01) | | | | | |
| RR x Price | | 0.12*** | | | | |
| | | (0.03) | | | | |
| Natural gas windfall | | | 0.11*** | | | |
| | | | (0.01) | | | |
| Resource windfall | | | | 0.26*** | 0.2*** | 0.05*** |
| | | | | (0.04) | (0.04) | (0.02) |
| R-squared, within | 0.14 | 0.14 | 0.14 | 0.18 | 0.2 | 0.63 |
| Observations | 5230055 | 5230055 | 5190461 | 5190461 | 3813307 | 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), Extended Ad Tone Index (Column 4), CMAG tone index (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. 'Resource windfall' is the baseline measure of resource windfalls, namely the interaction of the (cross-sectional) state recoverable stocks of crude oil and the average, monthly-based, international price of crude oil ($ per barrel), normalized by states' land area. 'Natural gas windfall' is the natural gas equivalent 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, Louisiana, Montana, North Dakota, New Mexico, Oklahoma, Texas, and Wyoming, and the average, monthly-based, international price of crude oil ($ per barrel). For further information on variables see data Appendix.

### 4.3.5 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 Subsection appear in Table 5. First, in Column 1 we exclude the three resource-richest states, as observed in Figure 2, namely North Dakota, Texas, and Wyoming. This exclusion enables examining the extent to which the main results are driven by the states with relatively significant resource windfalls, and whether the main result is also apparent even in low-level variations. The estimated $\alpha$ indicates that the main result is robust to this examination, with the magnitude decreasing slightly (suggesting that the effect is relatively stronger in resource-rich states, yet is also apparent elsewhere). To examine this further, in Appendix Table A2 we consider the case of excluding the largest resource-rich states in absolute terms, namely Colorado, North Dakota, New Mexico, and Texas (recall, Alaska is already excluded from the main sample); as the outcome in Column 1 indicates, the main result is similarly robust to this exclusion.

Considering further restrictions, in Appendix Table A2 (Column 2) we also examine the exclusion of New Hampshire and Vermont, to focus on the sample of states that adopt 4-year term lengths. Under this restriction government durability is fixed. Furthermore, in the same table (Column 3) we also consider the exclusion of California, New York, and Texas from the sample, to test the robustness of the key results to the exclusion of the three largest states. This restriction addresses the concern that the main results may be driven by the dominant states. Last, to further test the potential role of outliers in driving the main outcome, in Appendix Table A3 we exclude each of the states separately. The estimated $\alpha$s in all cases indicate that the main result is robust to these restrictions; more specifically, consistent with the previous observed patterns, the results suggest that the effect is relatively stronger in resource-rich states.

Second, we test a different clustering level. The baseline analysis follows a conservative two-way clustering approach across the two basic dimensions of the data. An additional conservative perspective may consider solely the state level, as it may have unique and persistent features, correlated within and across election races. Hence, we cluster the standard errors at the state level. The results in Column 2 indicate that the main outcome is robust to this change. Further examinations of additional clustering levels are presented in Appendix Table A2. Specifically, we undertake clustering by time of day, and type of program (Columns 4-5, respectively). The results indicate that the main effect is robust to these modifications.

Third, we consider the possibility of serial correlation in the extent of negativity. Going negative may be a reaction to previous movements towards negativity by contenders; i.e., candidates facing attacks by contenders may retaliate. To examine that, we consider the average Ad Tone Index for ads aired in the precedent month targeting the current ad's candidate. In effect, this measure provides the average negativity that a candidate faces contemporaneously (by looking back at the negativity targeted specifically at that candidate in the precedent month). Given the required matching between the precedent-month's targeted individual across ads, and the current ad's candidate, the examined sample drops significantly. Nonetheless, the results in Column 3 indicate that the main effect remains to hold. In addition, they illustrate that the magnitude of previous attacks is indeed correlated with a boost in contemporaneous negativity as conjectured.

Fourth, we address the discrete nature of our outcome variable and estimate the baseline specification via Probit estimation, reporting marginal effects in Column 4. The results indicate that the main effect is robust to this estimation procedure. Fifth, in Column 5, we exploit the monthly frequency of our treatment, and add state-by-year fixed effects to the baseline specification. This addition, in effect, addresses state-by-year changes, including for instance, annual state-level controls ranging from GSP to corruption and electoral competition. The results of this demanding specification indicate that the main effect is robust to this addition, albeit significantly increasing in magnitude. An additional examination, adding state-specific time trends in lieu of state-by-year fixed effects, appears in Appendix Table A2 (Column 6). Such an addition enables controlling for additional related phenomena that occur over time.[54] The outcome in this case, as well, points at the robustness of the main result to this modification.

Sixth, 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 6 we restrict the sample to these three months, and observe that the main result remains to hold.

Seventh, we add controls for voter polarization, voter turnout, and political donations. Our theoretical analysis considers the impact of windfalls on candidates' incentives, noting that previous work pointed at the ambiguity of the impact manifested via voters' incentives.[55] To examine the potential role of voters' incentives, in Column 7 we add measures of affective polarization, per capita political donations, and voters' participation. The first is measured via (absolute value) state-aggregated differences in Liberals' and Conservatives' thermometer values from the American National Election Studies (ANES (2022)).[56] The second is measured by state-by-month per capita political contributions made by individuals and organizations to candidates in gubernatorial races, derived from Bonica (2022). The third is measured as the voting-eligible population turnout rate for the gubernatorial elections, computed via data from the U.S. Library of Congress. The estimated $\alpha$ indicates that the main outcome holds under these additions, suggesting that the impact of windfalls on negativity is not driven via changes in

[54]Examples include changes with respect to preferences over political campaigns, or technological changes related to ads' quality and transmission.

[55]See, e.g., Andersen et al. (2014), James and Rivera (2022), Sances and You (2022), and Ikan et al. (2024), as outlined earlier.

[56]In effect, we follow a state-aggregated variation of the measure adopted in Stewart et al. (2020).

voters' behavior, further motivating the focus on candidates' incentives. In addition, the results indicate that polarization and political donations (participation) are positively (negatively) associated with the extent of negativity.

Last, we undertake a candidate-month aggregation of the sample. In the baseline analysis, the treatment has monthly frequency and differentiates at the cross-section across states, while the outcome's unit of analysis is at the ad level. To examine whether this difference may affect the main results, we aggregate the baseline sample to be at the candidate-month level, for each election race (i.e. for each state-by-year cell). This mitigates treatment-outcome differences, while still differentiating between candidates; however, this aggregation comes at a cost of reducing the sample size considerably. Under this aggregation we estimate the baseline specification, in which the monthly unit is adopted in lieu of the daily one; i.e., month fixed effects are employed, instead of day fixed effects, and standard errors are clustered by state and month (as opposed to state and day). The estimated $\alpha$ indicates that the main result remains to hold, albeit in a relatively lower magnitude, under this aggregation.

Table 5: Additional tests

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| Dependent variable: Ad Tone Index | ND, TX, and WY excluded | Clustering by state | Retaliation | Probit estimation | State-by-year fixed effects | Restricted to December, January, February | Polarization, voter turnout, and donations | Candidate-month aggregation |
| Resource windfall | 0.09*** | 0.11*** | 0.08*** | 0.11*** | 0.29*** | 0.09*** | 0.09*** | 0.09** |
| | (0.03) | (0.01) | (0.02) | (0.02) | (0.06) | (0.02) | (0.07) | (0.04) |
| Previous attack | | | 0.98*** | | | | | |
| | | | (0.01) | | | | | |
| Political donations | | | | | | | 0.03*** | |
| | | | | | | | (0.08) | |
| Polarization | | | | | | | 0.005*** | |
| | | | | | | | (0.001) | |
| Voter turnout | | | | | | | -0.004** | |
| | | | | | | | (0.002) | |
| R-squared | 0.14 | 0.14 | 0.9 | 0.1 | 0.19 | 0.12 | 0.18 | 0.11 |
| Observations | 4980302 | 5190461 | 512346 | 5190461 | 5190460 | 849795 | 3720784 | 3227 |

Notes: Standard errors are robust, clustered by state and day (by state in Column 2, and state and month in Column 8), 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 (Column 5 also includes state-by-year fixed effects; Column 8 includes month fixed effects instead of the day-level ones). The sample includes TV political ads related to state gubernatorial elections in the 48 continental states (WY, TX, ND are excluded in Column 1), covering the period 2010-2020; in Column 6 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 crude oil and the average, monthly-based, international price of crude oil ($ per barrel), normalized by states' land area. 'Polarization' is affective polarization as outlined in the text. 'Voter turnout' is the voting-eligible population turnout rate for the gubernatorial elections. 'Political donations' is state monthly per capita political donations. 'Previous attack' is the average Ad Tone Index for ads aired in the precedent month targeting the current ad's candidate. Column 4 follows a Probit estimation, reporting marginal effects. In Column 8 the sample is aggregated at the candidate-month level within election races (state-year). 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 a positive exogenous shock in the economy 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 they provide for gaining support while in office, and extract 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 the international price of oil. Preliminary analyses, via the case study of Alaska, event study analysis, and a RD-design based on the COVID-induced 2020 oil price changes, provide initial support for the main hypothesis, which is thereafter examined more thoroughly in the main analysis. Consistent with the theoretical predictions, the empirical estimates of the main analysis 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 daily-level data 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)**[57]

Ad Tone Index: A binary index that measures the extent to which the TV ad reflects a non-negative (promoting the candidate, or contrasting between candidates) or negative (attacking contenders) tone. It takes the values 0-1, as follows: 0 non-negative; 1 negative.

*Extended 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.

*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

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

Table A1: Descriptive statistics

| | Mean | Std. Dev. | Min. | Max. |
|---|---|---|---|---|
| Ad tone index (ad) | 0.346 | 0.476 | 0 | 1 |
| Extended ad tone index (ad) | 1.912 | 0.879 | 1 | 3 |
| CMAG tone index (ad) | 1.957 | 0.921 | 1 | 3 |
| Target indicator (ad) | 0.388 | 0.487 | 0 | 1 |
| Resource windfall (state; monthly; in $million; per 100 sq miles) | 0.328 | 0.414 | 0 | 5.407 |
| Mining output per capita (state; annual; in $million) | 0.001 | 0.002 | 0 | 0.022 |
| Natural gas windfall (state; monthly; in $million; per 100 sq miles) | 0.794 | 1.111 | 0 | 6.019 |
| Gross State Product per capita (state; annual; in $1000) | 51.880 | 9.054 | 33.954 | 84.592 |
| Corruption index, z-normalized (state; annual) | -0.06 | 0.99 | -2.486 | 5.102 |
| Electoral competition (state; annual) | 0.289 | 0.453 | 0 | 1 |
| Candidate party (ad) | 2.103 | 0.889 | 1 | 3 |
| Incumbent (ad) | 0.189 | 0.392 | 0 | 1 |
| Ad sponsor (ad) | 0.743 | 1.237 | 0 | 3 |
| Ad length, seconds (ad) | 30.076 | 5.497 | 5 | 120 |
| Ad cost (ad; in $10000) | 0.587 | 1.838 | 0 | 228.980 |
| Polarization (state; annual) | 30.619 | 4.464 | 17.5 | 47.886 |
| Voter turnout rate (state; annual) | 0.51 | 0.095 | 0.27 | 0.72 |
| Political donations (state; monthly) | 0.902 | 0.826 | 0.00 | 6.605 |
| Manufacturing share (state; annual) | 0.103 | 0.042 | 0.01585 | 0.207995 |
| Services share (state; annual) | 0.329 | 0.063 | 0.06271 | 0.478529 |
| Wholesale and retail share (state; annual) | 0.113 | 0.014 | 0.06948 | 0.175302 |
| Government share (state; annual) | 0.178 | 0.034 | 0.1177 | 0.34423 |

Notes: See Appendix for detailed description of variables.

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**[58]

*Resource windfall*: The baseline measure of state-by-month resource windfalls, constructed as the interaction of the cross-sectional state recoverable stocks of crude oil (AK and HI excluded) and the average monthly international prices of crude oil, normalized by states' land area. Source of the underlying cross-sectional measure: James (2015).

*Positive/negative price change*: This measure captures the cases of positive (negative) percent change in the average monthly oil price relative to the precedent month, multiplied by the baseline 'Resource windfall' measure.

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

*Natural gas windfall*: State-by-month natural-gas-based resource windfalls, constructed as the interaction of the cross-sectional state recoverable stocks of natural gas (AK and HI excluded) and the average monthly international prices of natural gas, normalized by states' land area. 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.

*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.

*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).

*Polarization*: The absolute value of the difference between Liberals' thermometer (variable

[58]Variables in this groups are at the U.S. state level, and unless otherwise specified, they are at the annual frequency.

VCF0211 in the source survey) and Conservatives' thermometer (variable VCF0212 in the source survey), each reporting the respondent's feelings towards the corresponding group, on a scale between 0 and 100, aggregated to the state level, available for 2012, 2016, 2020. Source: ANES (2022).

*Voter turnout*: Voting-eligible population turnout rate for the gubernatorial elections. Source: U.S. Library of Congress.

*Political contributions per capita*: State-by-month political contributions made by individuals and organizations to candidates in gubernatorial races, normalized by (annual) state population. Source: Bonica (2022).

*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**: , normalized by state population. Source: BEA.

*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).

*Income taxes*: States are divided based on a binary variable that is 1 for states that levy income taxes over the course of our sample period, and 0 otherwise. The latter group includes: AK, FL, NV, NH, SD, TN, TX, WA, WY. Source: Grossmann et al. (2021).

*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 Tables

This section presents Appendix Tables; specifically, Tables A2 and A3.

Table A2: Robustness tests

| Dependent variable: Ad Tone Index | (1) CO, ND, NM, and TX excluded | (2) NH, and VT excluded | (3) CA, NY, and TX excluded | (4) Clustering by time of day | (5) Clustering by type of program | (6) State time trends |
|---|---|---|---|---|---|---|
| Resource windfall | 0.09*** | 0.11*** | 0.07*** | 0.11*** | 0.12*** | 0.09*** |
| | (0.02) | (0.02) | (0.02) | (0.02) | (0.01) | (0.02) |
| R-squared | 0.14 | 0.14 | 0.15 | 0.14 | 0.14 | 0.14 |
| Observations | 4861406 | 5134692 | 4594119 | 5190461 | 5073584 | 5190461 |

Notes: Standard errors are robust, clustered by state and day (by the time of day during which ad aired in Column 4; by the type of television program during which ad aired in Column 5), 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 (Column 6 also includes state-specific time trends). The sample includes TV political ads related to state gubernatorial elections in the 48 continental states (CO, ND, NM, and TX 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. 'Resource windfall' is the baseline measure of resource windfalls, namely the interaction of the (cross-sectional) state recoverable stocks of crude oil and the average, monthly-based, international price of crude oil ($ per barrel), normalized by states' land area. For further information on variables see data Appendix.

# Appendix C Proofs

## C.1 Proof of Proposition 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,

Table A3: State exclusions

| State excluded | Resource windfall | standard errors | observations | State excluded | Resource windfall | standard errors | observations |
|---|---|---|---|---|---|---|---|
| Alabama (AL) | 0.105*** | 0.02 | 5116496 | North Carolina (NC) | 0.091*** | 0.02 | 5052923 |
| Arkansas (AR) | 0.102*** | 0.02 | 5162558 | North Dakota (ND) | 0.087*** | 0.03 | 5173934 |
| Arizona (AZ) | 0.101*** | 0.02 | 5134724 | Nebraska (NE) | 0.107*** | 0.02 | 5154947 |
| California (CA) | 0.084*** | 0.02 | 4871411 | New Hampshire (NH) | 0.112*** | 0.02 | 5167280 |
| Colorado (CO) | 0.106*** | 0.02 | 5117389 | New Jersey (NJ) | 0.106*** | 0.02 | 5170532 |
| Connecticut (CT) | 0.107*** | 0.02 | 5127379 | New Mexico (NM) | 0.105*** | 0.02 | 5135234 |
| Delaware (DE) | 0.105*** | 0.02 | 5189872 | Nevada (NV) | 0.108*** | 0.02 | 5124136 |
| Florida (FL) | 0.087*** | 0.02 | 4625726 | New York (NY) | 0.116*** | 0.02 | 5097396 |
| Georgia (GA) | 0.101*** | 0.02 | 5013012 | Ohio (OH) | 0.09*** | 0.02 | 5016205 |
| Iowa (IA) | 0.098*** | 0.02 | 5084357 | Oklahoma (OK) | 0.102*** | 0.02 | 5139366 |
| Idaho (ID) | 0.102*** | 0.02 | 5135841 | Oregon (OR) | 0.111*** | 0.02 | 5088773 |
| Illinois (IL) | 0.104*** | 0.02 | 4893397 | Pennsylvania (PA) | 0.093*** | 0.02 | 5029715 |
| Indiana (IN) | 0.101*** | 0.02 | 5102586 | Rhode Island (RI) | 0.101*** | 0.02 | 5150027 |
| Kansas (KS) | 0.106*** | 0.02 | 5124542 | South Carolina (SC) | 0.111*** | 0.02 | 5086817 |
| Kentucky (KY) | 0.099*** | 0.02 | 5050041 | South Dakota (SD) | 0.129*** | 0.02 | 5155610 |
| Louisiana (LA) | 0.115*** | 0.02 | 5016666 | Tennessee (TN) | 0.099*** | 0.02 | 5041928 |
| Massachusetts (MA) | 0.109*** | 0.02 | 5142791 | Texas (TX) | 0.103*** | 0.02 | 5006232 |
| Maryland (MD) | 0.108*** | 0.02 | 5137664 | Utah (UT) | 0.109*** | 0.02 | 5176012 |
| Maine (ME) | 0.097*** | 0.02 | 5117456 | Virginia (VA) | 0.108*** | 0.02 | 5044939 |
| Michigan (MI) | 0.117*** | 0.02 | 4984077 | Vermont (VT) | 0.104*** | 0.02 | 5157873 |
| Minnesota (MN) | 0.103*** | 0.02 | 5125601 | Washington (WA) | 0.142*** | 0.02 | 5138266 |
| Missouri (MO) | 0.097*** | 0.02 | 5021565 | Wisconsin (WI) | 0.113*** | 0.02 | 4926519 |
| Mississippi (MS) | 0.103*** | 0.02 | 5137682 | West Virginia (WV) | 0.114*** | 0.02 | 5094073 |
| Montana (MT) | 0.129*** | 0.02 | 5009005 | Wyoming (WY) | 0.106*** | 0.02 | 5181058 |

Notes: Each row represents a regression in which the sample excludes the state noted in the corresponding row. Each row reports the estimate of 'Resource windfall', its standard errors, and number of observations; the R-squared in all cases is 0.14. The dependent variable in all cases is the Ad Tone Index. 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. 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. 'Resource windfall' is the baseline measure of resource windfalls, namely the interaction of the (cross-sectional) state recoverable stocks of crude oil and the average, monthly-based, international price of crude oil ($ per barrel), normalized by states' land area. For further information on variables see data Appendix.

all the following four FOCs must be jointly satisfied:

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

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

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

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

Combining every two equations for every player $i$, we get

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

which translates to

$$s_i = \left[\frac{v\beta}{\alpha}\right]^{\frac{1}{1-\beta}} e_i^{\frac{1-\alpha}{1-\beta}}. \tag{10}$$

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 $\epsilon_1$ and $\epsilon_2$ 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

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

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. $\square$

## C.2 Proof of Proposition 2

**Proof**. Denote $\Delta v = v_1 - v_2 > 0$. We can follow the same stages given in the proof of Proposition 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:

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

Reverting to the original notations, we get

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

Using the fact that $f(\cdot)$ is symmetric, the first statements of the proposition 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

$$
s_i^{1-\beta} = \left[\frac{v_{-i}\beta}{\alpha}\right] e_i^{1-\alpha}, \tag{11}
$$

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 $f$:

$$c'\left(e_1+s_1\right)\cdot e_1^{1-\alpha}=c'\left(e_2+s_2\right)\cdot e_2^{1-\alpha}. \tag{12}$$

Now assume, by contradiction, that $e_2 \geq e_1$. Since $v_1 > v_2$, it follows from Equation (11) 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 (12). Thus, we conclude that $e_1 > e_2$. This inequality, along with Equation (12) 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. □

## C.3 Proof of Lemma 1

**Proof**. Let $F_\epsilon$ and $f_\epsilon$ be the CDF and density function of $\epsilon_i$, 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

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

Note that $f_\epsilon^*$ is a simple transformation of $f_\epsilon$ 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. □