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A Political Agency Model of Coattail Voting*

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Abstract

In this paper, I provide a formal justification for a well-established coattail effect, when a popular candidate at one branch of government attracts votes to candidates from the same political party for other branches of government. A political agency framework with moral hazard is applied to analyze coattails in simultaneous presidential and congressional elections. I show that coattail voting is a natural outcome of the optimal reelection scheme adopted by a representative voter to motivate politicians' efforts in a retrospective voting environment. I assume that an office-motivated politician (executive or congressman) prefers her counterpart to be affiliated with the same political party. This correlation of incentives leads the voter to adopt a joint performance evaluation rule, which is conditioned on the politicians belonging to the same party or different parties. The two-sided coattail effects then arise. On the one hand, the executive's success/failure props up/drags down her partisan ally in congressional election, which implies presidential coattails. On the other hand, the executive's reelection itself is affected by the congressman's performance, which results in reverse coattails.

JEL classification: D72, D86.

Keywords: Coattail voting; Presidential coattails; Reverse coattails; Simultaneous elections; Political Agency; Retrospective voting.

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1. Introduction

The coattail effect is defined as the tendency of a popular candidate at one level of government to attract votes to candidates from the same political party for other levels of government. The presidential coattails, when the congressional voting decision is affected by the executive's performance, have been a topic of frequent study in the empirical literature (see Miller 1955, Press 1958, Kaplowitz 1971, Calvert and Ferejohn 1983, Campbell 1986, Campbell and Sumners 1990, Flemming 1995, Cohen et al. 2000, Mattei and Glasgow 2005, Gélineau and Remmer 2006, Golder 2006, among many others). Other studies have reported evidence of reverse coattails, when popular lower-tier candidates prop up their parties' candidates for higher levels of government (see Ames 1994, Samuels 2000a, Samuels 2000b).[1]

While a number of studies have identified and measured coattails, "there remains a great deal of uncertainty concerning the causal mechanism responsible for these effects."[2] Mondak and McCurley (1994) suggest that the coattails arise mainly due to "voters' reliance on a specific cognitive efficiency mechanism" and test this claim empirically at the individual voter level.[3] There is however no formal model of coattail voting, to the best of my knowledge.

In this paper, I explain coattail effects within a retrospective voting model (i.e., a political agency model with moral hazard). In my framework, coattail voting arises as an outcome of the optimal implicit reward scheme voters use to induce politicians' efforts.

I consider a representative voter that has to elect an executive and congressman in simultaneous elections. The politicians want to be reelected, and are held accountable for their performance at the moment of election. The politicians therefore have incentives to satisfy the voter's wishes. In addition, I assume that the politicians are loyal to their respective political parties: the executive prefers her partisan ally to win in congressional election, and vice versa.[4] Hence, the incentives of the executive and congressman are correlated. The

[1] The cited works provide evidence of reverse coattails in Brazil. Broockman (2009) however found no evidence of reverse coattails in congressional district-level data from the US presidential elections between 1952 and 2004.

[2] See Hogan (2005), p. 587.

[3] See Mondak and McCurley (1994), p. 151.

[4] Fox and Van Weelden (2010) and Brollo and Nannicini (2010) introduce similar assumptions about the partisan preferences of the legislature and the executive, respectively. In particular, in Fox and Van Weelden's career concerns setup the legislature ("overseer") can care about the executive's reputation. For example, a partisan overseer may seek to damage the reputation of an executive from the other party while seeking to protect the reputation of an executive from his own party. In turn, Brollo and Nannicini (2010) assume that an executive wants to maximize "the political capital represented by aligned mayors," by increasing the likelihood that a municipality is run by a mayor aligned with the central government.

voter cares about the politicians' performances, which are observable but not contractible. The voter evaluates the incumbents' performance and votes accordingly. More precisely, the voter employs implicit evaluation rules when deciding whether to reward (reelect) politicians. Obviously, the voter can influence the politicians' behavior through the choice of evaluation rules. I restrict the space of possible evaluation rules to linear functions of performance.

I show that given the correlation between the two politicians' incentives, the voter is better off adopting a *joint* performance evaluation rule (conditioned on the incumbents belonging to the same party or different parties) rather than an *individual politician* performance evaluation rule. In particular, the voter evaluates the performance of the executive and congressman from the same party as a team. If the executive and congressman belong to different parties, then the voter compares their performances to create a competitive environment. This combination of coattail voting rules implies that improved performance increases a politician's own reelection probability, while increasing/decreasing the reelection probability of her partisan ally/rival in the other office. Politicians therefore have extra incentives to perform better, for the sake of their party as well as for themselves.

In equilibrium, the reelection outcomes of incumbents from the same party are therefore positively correlated: the voter tends to reward/punish one incumbent for the good/poor performance of the other incumbent. The two-sided coattail effects therefore arise. On the one hand, the executive's performance affects the congressman's reelection that gives rise to presidential coattails. On the other hand, the executive's reelection itself depends on the congressman's performance that results in reverse coattail effect.

The equilibrium reelection outcomes of incumbents from different parties are negatively correlated: the voter is more likely to punish one incumbent the better the performance of the other incumbent. In particular, the executive's good performance drags down the incumbent congressman's reelection chances and therefore props up the executive's partisan ally in congressional election, which implies presidential coattails. In turn, the congressman's success relegates the executive's reelection and thus promotes for presidential office a candidate partisanly aligned with the congressman. As a result, the reverse coattails arise.

These results rest on the assumption of politicians' *partisan alignment*; that is, I assumed that an executive/congressman prefers their partisan ally to win in the other election. The coattail voting rules then serve as an extra tool to discipline the politicians. If I relax the assumption of partisan alignment, this effect vanishes and the voter no longer evaluates incumbents jointly. Instead the voter uses a cut-off rule that each incumbent is reappointed only when her individual performance exceeds a critical threshold. There is no coattail effect then.

I turn now to the fundamental question of why political process is modeled as political agency. In addition to a sound theoretical framework, this approach has received considerable empirical support (see, for example, Peltzman 1992 and Besley and Case 1995a, 1995b, 2003). Besley (2006) provides an excellent introduction to political agency models and "emphasizes the empirical potential of these models in explaining real world policy choices."[5] In a recent article in the *New York Times*, Glaeser points out that the "president ... is both our leader and our employee. We (the voters) chose him, our taxes pay his salary, and we can fire him in four years."[6] The political agency approach may therefore be appropriate to model political interactions between politicians and voters. Even so, elected politicians can only be offered implicit incentive schemes; public policies are difficult to reward with explicit contracts.

The retrospective voting model I use goes back to Barro (1973). Ferejohn (1986) extended the model and studied subgame-perfect equilibria rather than Nash equilibria. Persson et al. (1997) use a retrospective voting approach to study rent extraction. In Austen-Smith and Banks (1989) voters adopt retrospective voting strategies that are conditioned on the difference between the incumbent's performance and her initial policy platform. Banks and Sundaram (1993, 1996) analyze retrospective voting settings with both moral hazard and adverse selection, and with term limits respectively.

The results of this paper are also related to the literature on horizontal and vertical intergovernmental competition. Most analyses of horizontal competition are based on the assumption of interjurisdictional mobility of consumers, à la Tiebout (1956). In a similar vein, the literature on yardstick competition between jurisdictions started with the seminal work of Salmon (1987), to be followed by Besley and Case (1995a), Bordignon et al. (2004), Sand-Zantman (2004), Belleflamme and Hindriks (2005), Besley and Smart (2007) and others. The main assumption of this literature is that under decentralization, voters use a comparative performance evaluation between different local governments to create yardstick competition.

The vertical competition literature, on the other hand, assumes that "senior and junior governments provide similar or comparable services, and that office-holders in the government which is judged by citizens to be the more efficient supplier will increase their probability of getting the vote of these citizens"[7] (see Breton 1996, Breton and Fraschini 2003, Breton and Salmon 2001, Volden 2005 and Volden 2007). I follow these authors in assuming that voters compare the performance of local and regional governments, and are likely to reward the

[5] Besley (2006), p. 3.

[6] Edward L. Glaeser "Lower (and More Realistic) Presidential Expectations," January 20, 2009. Available online at http://economix.blogs.nytimes.com/2009/01/20/lower-and-more-realistic-presidential-expectations/ (accessed December 1, 2010).

[7] Breton and Salmon (2001), p. 139.

more efficient politicians with reelection. There is, however, an important difference between my research and the papers just cited. In the intergovernmental competition literature, the comparative performance evaluation result is driven by either correlated shocks or interjurisdictional spillover. In my model, the joint performance evaluation arises from the fact that the politicians' incentives are correlated: each one cares not only about her own reelection prospects, but also about the success of other politicians affiliated with the same political party.

The remainder of the paper is organized as follows. Section 2 lays out a model. Section 3 proceeds with the formal analysis. Finally, Section 4 concludes.

2. Model

Consider a representative voter that has to elect executive E and congressman C in simultaneous elections. Politicians running for both offices belong to one of the two political parties. I assume that there is exactly one candidate from each party–the incumbent and an opponent–in each election. The opponents are identical to the incumbents in all respects except party label. There is no ideological heterogeneity in politicians' preferences.[8] The participation constraints of the politicians are always satisfied.

While in office, each politician $i \in \{E, C\}$ has to implement a policy determined by her unobservable effort a_i. The set of efforts available to each politician is taken to be a non-degenerate interval $[0, \overline{a}] \subset \mathbb{R}$. I assume that the performance of politician i, p_i, is observed with an independent and unobservable noise ε_i:

$$p_i = a_i + \varepsilon_i,$$

with $\varepsilon_i \sim N\left(0, \sigma^2\right)$.[9,10,11]

[8] Since there is no ideological component it is convenient to consider a single representative voter in this framework.

[9] I have an extended version of the model, available upon request, where the two noise terms ε_E and ε_C are correlated and follow a bivariate normal distribution. I want to concentrate however on the case where the voter introduces joint performance evaluation due to the correlation between politicians' incentives rather than the correlation between shocks. The latter topic has been widely studied in the context of team evaluation in contract theory (for an overview, see Bolton and Dewatripont 2005) and in the literature on yardstick competition (see the references on yardstick competition in the Introduction).

[10] One can assume that policy outcomes are determined by effort and ability (rather than by effort and noise). The results are qualitatively the same if politicians choose efforts before knowing their abilities. Otherwise, one has to solve an asymmetric information model. I leave this extension for future research.

[11] Alternatively, the voter might not be able to distinguish between the politicians' performances, and

The reward of politician i is denoted by $\Pi_i(a_i)$. Effort is costly, and I assume the standard convex cost function $\frac{a_i^2}{2}$.[12] The executive and congressman independently choose effort levels a_i to maximize their utility, which is given by

$$\Pi_i(a_i) - \frac{a_i^2}{2}.$$

The function $\Pi_i(a_i)$ will be explicitly defined in subsection 2.1.

The voter cares about the politicians' performances according to a linear utility function

$$p_E + p_C.$$

I assume that the voter applies retrospective reappointment rules to reelect the incumbents, i.e., she bases the reappointment decision on the politicians' performances p_E and p_C.

Denote by $\phi \in \{S, D\}$ the state variable. Then $\phi = S$ corresponds to the case where executive E and congressman C are members of the same party, and $\phi = D$ to the case where E and C are affiliated with different parties.

This is a sequential political agency game between politicians (the executive and congressman) and a representative voter. The timing of events is as follows. First, the incumbents are drawn randomly, and state $\phi \in \{S, D\}$ is realized. Second, the voter commits to the reappointment rules to be used in the coming elections. Third, the politicians exert efforts a_E and a_C. Finally, nature chooses noises ε_E and ε_C, and the politicians' performances p_E and p_C are observed. Both elections take place simultaneously and the voter applies the selected reappointment rules to reward or punish the incumbents.[13]

In the following subsection I describe the politicians' preferences. I will then turn to the voter's problem and define an equilibrium concept.

2.1. Politicians

The politicians' preferences are as follows. First, executive E and congressman C want to be reelected. Moreover, E wants to improve her party's representation in legislature. If C and E belong to the same party, then E prefers C to be reelected. Otherwise, E wants a

therefore observes just their aggregate performance $p = a_E + a_C + \varepsilon$. In that case the politicians would face a free-riding problem, as each of them contributes a costly effort to an aggregate output. I leave the analysis of that alternative framework for future research.

[12] I have an extended version of the model, available upon request, where the cost of policy implementation for the executive and congressman from the same party is different than for the politicians from rival parties (e.g., because of synergy). The results of this extended model are qualitatively the same.

[13] This model can be extended to several periods. I want to concentrate however on voter's motives for coattail voting rather than on dynamic political agency. A static model suffices this task.

new congressman (from her own party) to be elected for the next term. Likewise, C wants to improve his party's chances to win the presidential election. Thus, C wants E to be reelected if they are members of the same party, and wants the opponent to be appointed if E is from the rival party. The value of holding office is normalized to 1. The values, which E and C associate to their parties' winning the other elections, are denoted by λ_E and λ_C respectively. Furthermore, denote by $\Pr_i(\cdot)$ the probability of winning election $i \in \{E, C\}$. Therefore, politician i has the following reward function $\Pi_i : [0, \overline{a}]^2 \to \mathbb{R}$ that depends continuously on both politicians' efforts:

$$\Pi_i(a_i, a_j, \phi) = \begin{cases} \Pr_i(a_i, a_j) + \lambda_i \Pr_j(a_i, a_j) & \text{if} \quad \phi = S \\ \Pr_i(a_i, a_j) + \lambda_i (1 - \Pr_j(a_i, a_j)) & \text{if} \quad \phi = D, \end{cases}$$

where $i, j \in \{E, C\}$ and $j \neq i$. The preferences stated above reflect the politicians' allegiance to their respective parties; individual politicians care about their party's overall representation in executive and legislative branches of government, not just their own reelection prospects.[14] Still, the reasonable assumption here is that a politician values her own office more than her party's representation in the other office; i.e., $0 \leq \lambda_i \leq 1$.[15] I call λ_i the degree of politician i's loyalty to her party (or the strength of her partisan alignment).[16]

2.2. Representative Voter

The politicians' performances p_E and p_C (but not their composition between effort and noise) are observed but are not contractible. Public policies are difficult to reward with explicit contracts. It is more natural to use implicit incentive contracting in this situation.

The voter observes politicians' performances p_E and p_C, and in the elections rewards incumbents according to their performances; i.e., the voter reappoints incumbents who have shown "good" results. In case an incumbent is thrown out of office, an opponent from the rival party is elected.

[14] Alternatively, the stated preferences could arise because the executive and congressman have to interact while in office. Each prefers working with a member of her own party rather than a rival.

[15] In other words, politician i does not mind reducing her reelection chances by 1% in exchange for increasing her ally's election probability by $\frac{1}{\lambda_i}\% \geq 1\%$.

[16] I have an extended version of the model, available upon request, where the strength of partisan alignment λ_i might vary across states. If there is some preference for incumbents over unknown candidates, then $\lambda_i^S \geq \lambda_i^D$. (This case reflects the idea that an executive/congressman might prefer an incumbent ally to an unknown ally for the other office.) If politicians prefer newcomers, then $\lambda_i^S < \lambda_i^D$. (In this case an executive/congressman would like a new ally (a newcomer) to be elected for the other office.) The results of this extended model are qualitatively the same.

Obviously the voter can influence the politicians' behavior through the choice of evaluation rules. Intuitively, since politicians care about each others' reelection chances, the reward rules should allow for joint performance evaluation. Under joint performance evaluation the voter conditions politician i's reelection on her own performance p_i (giving her an incentive to perform well since she wants to be reelected) and on the performance p_j of politician j (giving an incentive to politician j since he cares about i's reelection chances).

I restrict the functional space of performance evaluation rules to linear joint evaluation rules (β_E, b_E) and (β_C, b_C). β_E and β_C are the slopes of the executive's and congressman's performance evaluation rules respectively, while b_E and b_C are the corresponding intercepts; $\beta_E, \beta_C, b_E, b_C \in \mathbb{R}$, $|\beta_E \beta_C| \leq 1$.[17] Under rules (β_i, b_i), $i \in \{E, C\}$, the probability of being reelected for office i is

$$Pr_i(a_i, a_j) = P(\{p_i(a_i) + \beta_i p_j(a_j) \geq b_i\})$$

with $i, j \in \{E, C\}$ and $j \neq i$. Figure 1 depicts the possible outcomes for E and C under rules (β_E, b_E) and (β_C, b_C) in the two-dimensional space of observed performances p_E and p_C. Note that I require $|\beta_E \beta_C| \leq 1$, so that line $p_E + \beta_E p_C = b_E$ is steeper than line $p_C + \beta_C p_E = b_C$. Otherwise, as one can see from Figure 1, an executive and congressman with poor performance would be reelected while politicians with better performance would not.

Note that under linear rules (β_E, b_E) and (β_C, b_C), E is reelected when $\varepsilon_E + \beta_E \varepsilon_C \geq b_E - a_E - \beta_E a_C$, where $\varepsilon_E + \beta_E \varepsilon_C \sim N\left(0, \left(1 + \beta_E^2\right)\sigma^2\right)$. In turn, C is reelected when $\varepsilon_C + \beta_C \varepsilon_E \geq b_C - a_C - \beta_C a_E$, where $\varepsilon_C + \beta_C \varepsilon_E \sim N\left(0, \left(1 + \beta_C^2\right)\sigma^2\right)$. I say that the two reelection events are independent when $\beta_E = 0$ and $\beta_C = 0$, positively correlated when $\beta_E > 0$ and $\beta_C > 0$, and negatively correlated when $\beta_E < 0$ and $\beta_C < 0$. Throughout the rest of the paper, I use F to denote the normal distribution function and f for the corresponding density.

2.3. Equilibrium Concept

I search for a subgame perfect equilibrium by analyzing the game backwards. First, I solve for the politicians' efforts a_E^ϕ and a_C^ϕ under rules (β_E, b_E) and (β_C, b_C) in each state ϕ. Second, I examine the voter's choice of evaluation rules $\left(\beta_E^\phi, b_E^\phi\right)$ and $\left(\beta_C^\phi, b_C^\phi\right)$ for each state ϕ. In what follows I introduce two definitions.

[17] The linear evaluation rules allow for a closed-form solution in this framework. I leave the analysis of general evaluation rules for future research.

Given linear performance evaluation rules (β_E, b_E) and (β_C, b_C), the equilibrium in effort strategies is a profile of efforts $\left(a_E^{\phi}, a_C^{\phi}\right)$ such that

$$\Pi_i\left(a_i^{\phi}, a_j^{\phi}, \phi\right) - \frac{a_i^{\phi 2}}{2} \geq \Pi_i\left(a_i, a_j^{\phi}, \phi\right) - \frac{a_i^2}{2} \text{ for each } a_i \in [0, \overline{a}],$$

where $i, j \in \{E, C\}$, $i \neq j$.

I define an equilibrium in rule strategies as the tuple $\left(\beta_E^{\phi}, b_E^{\phi}, \beta_C^{\phi}, b_C^{\phi}\right)$ such that

$$a_E^{\phi}\left(\beta_E^{\phi}, b_E^{\phi}, \beta_C^{\phi}, b_C^{\phi}\right) + a_C^{\phi}\left(\beta_E^{\phi}, b_E^{\phi}, \beta_C^{\phi}, b_C^{\phi}\right) = \max_{\substack{\beta_E, b_E, \beta_C, b_C \\ |\beta_E \beta_C| \leq 1}} a_E^{\phi}\left(\beta_E, b_E, \beta_C, b_C\right) + a_C^{\phi}\left(\beta_E, b_E, \beta_C, b_C\right),$$

where $\left(a_E^{\phi}(\cdot), a_C^{\phi}(\cdot)\right)$ is an equilibrium in effort strategies.

2.4. Intuition

Before proceeding with the formal analysis, I provide some intuitive considerations. The incumbents care about reelection chances of each other, which provides the voter with an additional tool to discipline them. The voter uses then joint performance evaluation to increase the politicians' accountability. Intuitively, the voter rewards an incumbent from one branch of government not only for her own performance but also for the performance of the incumbent from the other branch of government. That joint evaluation gives extra incentives for the latter incumbent to perform better since he cares about the reelection prospects of the former incumbent.

Such an evaluation strategy of the voter leads to coattail effects. Intuitively, the executive wants a congressman from the same party to be elected. An executive thus will perform better if her own performance increases the reelection chances of the allied incumbent congressman, while decreases those of the rival incumbent congressman. The voter uses this correlation of incentives and rewards (reelects) the incumbent congressman for the good executive's performance if the politicians are members of the same party. She however punishes the incumbent congressman for the good executive's performance if the politicians are affiliated with different parties. In this case, an opponent candidate (exactly from the same party as the executive) is elected in congressional election. Note that the presidential coattails arise here. The good performance of the incumbent executive leads not only to her own reelection but also to the election of a congressman from the same party, who "rides on the executive's coattails". If the incumbent executive shows poor performance in office her reelection chances decrease, likewise the election chances of a congressman from the same party. In this case there is a negative presidential coattail effect.

The same intuition (in reverse) works to show the emergence of reverse coattail effect. Since the congressman wants his partisan ally to be elected for presidential office, he has extra incentives to exert higher effort if the reelection chances of the allied executive increase, while those of the rival executive decrease, with his performance. The voter knows this and is more likely to reelect the incumbent executive affiliated with the same party as the congressman, if the congressman performs well. If the incumbents belong to different parties, then the voter tends to punish the incumbent executive for the good congressman's performance, which leads to the election of a challenger (affiliated with the same party as the congressman) for presidential office. The executive thus may benefit or suffer from a reverse coattail effect because her reelection is affected by the congressman's performance. The good congressman's performance props up, while the poor drags down, a candidate from the same political party for presidential office.

Note that the coattail effects arise because of the correlation of politicians' incentives such that each politician prefers her partisan ally to win the other election. Relaxing this assumption results in no coattail effect prediction. Indeed, if politicians just care about their own reelection the voter will reward them only for their own performance. So no coattail voting arises.

3. Analysis

In this section I analyze the game backwards to find a subgame perfect equilibrium. First, I characterize an equilibrium in effort strategies, and then an equilibrium in rule strategies.

3.1. Equilibrium in Effort Strategies

Let the voter use evaluation rules (β_i, b_i), $i, j \in \{E, C\}$. Under these rules the politician i's utility is

$$\Pi_i(a_i, a_j, \phi) - \frac{a_i^2}{2} =$$

$$\begin{cases} P\left(\{p_i(a_i) + \beta_i p_j(a_j) \geq b_i\}\right) + \lambda_i P\left(\left\{p_j(a_j) + \beta_j p_i(a_i) \geq b_j\right\}\right) - \frac{a_i^2}{2} & \text{if} \quad \phi = S \\ P\left(\{p_i(a_i) + \beta_i p_j(a_j) \geq b_i\}\right) + \lambda_i \left(1 - P\left(\left\{p_j(a_j) + \beta_j p_i(a_i) \geq b_j\right\}\right)\right) - \frac{a_i^2}{2} & \text{if} \quad \phi = D. \end{cases}$$

Politician i chooses effort a_i before observing realization of the noise, and takes the voter's expectations as given. The proposition below establishes the existence of an equilibrium in effort strategies. Continuity properties of the politicians' best response functions and Brouwer's Fixed Point Theorem are used to provide the result. Proofs of this and other propositions are given in the Appendix.

Proposition 1. *Under linear performance evaluation rules* (β_E, b_E) *and* (β_C, b_C) *with* $|\beta_E \beta_C| \leq 1$, *there exists an equilibrium in effort strategies* $\left(a_E^\phi, a_C^\phi\right)$ *if the following second-order conditions are satisfied:*

$$\begin{cases} -f'_{\varepsilon_i+\beta_i\varepsilon_j}\left(b_i - a_i^\phi - \beta_i a_j^\phi\right) - \lambda_i\beta_j^2 f'_{\varepsilon_j+\beta_j\varepsilon_i}\left(b_j - a_j^\phi - \beta_j a_i^\phi\right) - 1 < 0 \quad \text{if} \quad \phi = S \\ -f'_{\varepsilon_i+\beta_i\varepsilon_j}\left(b_i - a_i^\phi - \beta_i a_j^\phi\right) + \lambda_i\beta_j^2 f_{\varepsilon_j+\beta_j\varepsilon_i}\left(b_j - a_j^\phi - \beta_j a_i^\phi\right) - 1 < 0 \quad \text{if} \quad \phi = D, \end{cases} \tag{3.1}$$

where $i, j \in \{E, C\}$, $i \neq j$. *This equilibrium is defined implicitly by*

$$\begin{cases} f_{\varepsilon_i+\beta_i\varepsilon_j}\left(b_i - a_i^\phi - \beta_i a_j^\phi\right) + \lambda_i\beta_j f_{\varepsilon_j+\beta_j\varepsilon_i}\left(b_j - a_j^\phi - \beta_j a_i^\phi\right) - a_i^\phi = 0 \quad \text{if} \quad \phi = S \\ f_{\varepsilon_i+\beta_i\varepsilon_j}\left(b_i - a_i^\phi - \beta_i a_j^\phi\right) - \lambda_i\beta_j f_{\varepsilon_j+\beta_j\varepsilon_i}\left(b_j - a_j^\phi - \beta_j a_i^\phi\right) - a_i^\phi = 0 \quad \text{if} \quad \phi = D. \end{cases}$$

Figure 2 depicts the politicians' best response functions in states S and D for three scenarios: independent reelection outcomes with $\beta_E = 0$ and $\beta_C = 0$ (black), positively correlated reelection outcomes with $\beta_E > 0$ and $\beta_C > 0$ (red), and negatively correlated reelection outcomes with $\beta_E < 0$ and $\beta_C < 0$ (blue), while b_E and b_C are fixed. Note that for independent reelection outcomes (black) the best responses are flat in both states (since each politician's reelection depends only on her own effort). For positively correlated reelection outcomes (red) the best responses shift upwards if the politicians are members of the same party ($\phi = S$) and downwards if the politicians are affiliated with different parties ($\phi = D$). Intuitively, under positively correlated reelections a politician has extra incentive to exert effort if $\phi = S$ (to increase her partisan ally's reelection chances) and less incentive if $\phi = D$ (to avoid helping her partisan rival get reelected). Finally, for negatively correlated reelection outcomes (blue) the best responses shift downwards if the politicians belong to the same party ($\phi = S$) and upwards if the politicians are affiliated to rival parties ($\phi = D$). In this scenario a politician does not want to damage her partisan ally's reelection prospects, so exerts a lower effort if $\phi = S$. However, if $\phi = D$ she has extra incentive to work harder and reduce her partisan rival's reelection chances.

Note that under positively correlated reelection outcomes there is a free-riding effect between partisan allies ($\phi = S$). Intuitively, politician i might prefer to exert a lower effort (and reduce effort cost) if her partisan ally j is performing well enough to improve her reelection prospects. In fact, she "rides on the other incumbent's coattails".

3.2. Equilibrium in Rule Strategies

Turn now to the voter's choice of evaluation rules (β_E, b_E) and (β_C, b_C). Maximizing $a_E^\phi + a_C^\phi$ with respect to β_E, b_E, β_C and b_C yields an equilibrium in rule strategies $\left(\beta_E^\phi, b_E^\phi, \beta_C^\phi, b_C^\phi\right)$. I summarize the results in the following proposition.

Proposition 2. *There exists an equilibrium in rule strategies* $\left(\beta_E^{\phi}, b_E^{\phi}, \beta_C^{\phi}, b_C^{\phi}\right)$ *given by*

$$\left(\beta_i^{\phi}, b_i^{\phi}\right) = \begin{cases} \left(\lambda_j, a_i^* + \lambda_j a_j^*\right) & \text{if} \quad \phi = S \\ \left(-\lambda_j, a_i^* - \lambda_j a_j^*\right) & \text{if} \quad \phi = D, \end{cases} \tag{3.2}$$

where $i, j \in \{E, C\}$, $i \neq j$. *The politicians' equilibrium efforts* a_i^* *in each state are equal to*

$$a_i^* = \frac{1}{\sqrt{2\pi}\sigma}\left(\frac{1}{\sqrt{1+\lambda_j^2}} + \frac{\lambda_i^2}{\sqrt{1+\lambda_i^2}}\right). \tag{3.3}$$

It is important to mention that the second-order conditions (3.1) hold for $\left(\beta_E^{\phi}, b_E^{\phi}, \beta_C^{\phi}, b_C^{\phi}\right)$. The equilibrium in effort strategies in Subsection 3.1 is therefore well defined.

The voter is rational, so she realizes that the only alternative to reelecting incumbents is voting for opponents from rival parties. The politicians' performances are additively separable in effort and noise, and all politicians behave in the same way irrespective of the noise. If elected, opponent i will exert equilibrium effort a_i^*, which maximizes her expected utility. Thus, the voter compares the incumbents' performances with their opponents' expected performances and votes accordingly. That is why in equilibrium

$$b_i^{\phi} = a_i^* + \beta_i^{\phi} a_j^*.$$

According to Proposition 2, if politician j is loyal to his political party (i.e., $\lambda_j \neq 0$), the voter adopts a coattail voting rule to reelect politician i. The probability of being reelected to office i under this rule is equal to

$$Pr_i\left(a_i, a_j, \phi\right) = \begin{cases} P\left(\left\{p_i\left(a_i\right) + \lambda_j p_j\left(a_j\right) \geq a_i^* + \lambda_j a_j^*\right\}\right) & \text{if} \quad \phi = S \\ P\left(\left\{p_i\left(a_i\right) - \lambda_j p_j\left(a_j\right) \geq a_i^* - \lambda_j a_j^*\right\}\right) & \text{if} \quad \phi = D. \end{cases}$$

Intuitively, the incentives of an executive and congressman are correlated, because they care about the overall representation of their party at both branches of government. The voter therefore rewards politicians jointly rather than separately.

If the politicians belong to the same political party ($\phi = S$), then the voter uses a coattail voting rule under which the reelection of politician i is positively correlated with the performance of politician j ($\beta_i^{\phi} > 0$). As a result, the voter evaluates the performance of the politicians from the same party as a team and tends to reward the incumbents from a well-performing party while punish the incumbents from a badly-performing party. However, if the politicians belong to different parties ($\phi = D$), the voter uses a coattail voting rule

under which the reelection of politician i is negatively correlated with the performance of politician j ($\beta_i^\phi < 0$). As a result, the voter compares the performance of one politician to that of the other, creating a competitive environment between the parties. In this scenario the voter tends to reward the incumbent from the better-performing party, while punishing the incumbent from the worse-performing party. In sum, due to the correlation between the executive's and congressman' incentives such that they care about their *party* chances of holding office, the voter is better off adopting *party* performance evaluation rather than *individual* performance evaluation.

This leads to two-sided coattail effects. On the one hand, the executive's good performance props up, while the poor drags down, the congressman candidate from the same party. The presidential coattails arise then. On the other hand, the executive's own reelection depends on the congressman's performance, which gives rise to a reverse coattail effect. Indeed, the successful performance of the congressman advances the election of his partisan for presidential office, while the congressman's failures cut it down.

Note that the intensity of coattail effects depends on the strength of politicians' partisan alignment. The more loyal the executive is to her political party (the higher λ_E is), the more correlated the optimal reward scheme for the congressman is with the executive's performance (positively if $\phi = S$ or negatively if $\phi = D$). The more intense therefore the presidential coattail effect. Analogically, the greater the partisan alignment of the congressman (the higher λ_C is), the more correlated the executive's reelection is with the congressman's performance. So the stronger the reverse coattail effect.

If the politicians care equally about their own reelection chances and their party's election chances, then the best reward scheme are perfectly correlated: the incumbents from the same party are always reelected or dismissed together; as for the incumbents from different parties, reelection of one implies dismissal of the other.

The less loyal the politicians are to their political parties, the less correlated their incentives. As a result, the voter adopts the less correlated reelection rules in equilibrium, and the coattail effects lessen. If politician j is not at all loyal to his political party ($\lambda_j = 0$), then the optimal rule to reappoint politician i is a simple cut-off rule: she is reappointed only if her observed performance exceeds a critical threshold given by the equilibrium effort for this office. That is, the probability of being reelected to office i depends only on the performance in this office:

$$Pr_i(a_i) = P(\{p_i(a_i) \geq a_i^*\}).$$

Intuitively, when politicians care only about their own reelection prospects, the voter is better off rewarding politician's individual performance rather than the party's performance. So coattail effects vanish. Indeed, if an executive cares only about her own reelection ($\lambda_E = 0$) then her performance does not affect the congressman's reelection chances, and a presidential coattail effect disappears. In turn, the performance of a non-partisan congressman ($\lambda_C = 0$) has no impact on the executive's reelection. So a reverse coattail effect does not arise if the incumbent congressman cares only about his own reelection prospects.

How do the equilibrium efforts a_i^* in (3.3) depend on parameters' values? First, larger variance of noise σ^2 decreases the politicians' efforts. Intuitively, more randomness in the observed performances p_E and p_C makes the reelection probabilities less sensitive to effort, reducing the politicians' incentives. Second, if politician i's partisan alignment λ_i is strengthened, the equilibrium effort of politician i, a_i^* increases while that of politician j, a_j^* decreases. Intuitively, the more politician i cares about her ally's appointment to office j, the more incentives she has to perform better. However, this weakens politician j's incentives to exert effort, because his reelection becomes less sensitive to his own effort. Note that the partisan executive and congressman exert the same equilibrium effort as the politicians from different parties. The reason is that the politicians' preferences are symmetric across the states. The voter adopts therefore symmetric strategies, and the politicians exert the same equilibrium effort regardless of the state.

3.3. Equilibrium Election Probabilities

In this subsection I calculate the equilibrium probabilities of election of partisanly aligned candidates and election of candidates affiliates with different parties. Denote by $P_{\phi S}$ the probability that the candidates from the same party are elected in state ϕ, and by $P_{\phi D}$ the probability that the candidates from different parties are elected in state ϕ. I establish the following result.

Proposition 3. *The equilibrium probability of election of the partisanly aligned candidates is given by*

$$P_{\phi S} = \frac{1}{2} + \frac{1}{\pi}\left(\arctan\lambda_E + \arctan\lambda_C\right), \quad \phi \in \{S, D\}.$$

The equilibrium probability of election of the candidates affiliated with different parties is given by

$$P_{\phi D} = \frac{1}{2} - \frac{1}{\pi}\left(\arctan\lambda_E + \arctan\lambda_C\right), \quad \phi \in \{S, D\},$$

where $\arctan(\cdot)$ *is the arctangent function.*

Note that independently of the incumbents' party labels, the election of partisan candidates is more likely than that of candidates affiliated with different political parties. Indeed, the probability of election of candidates from different parties is never greater than $\frac{1}{2}$: $P_{\phi D} \in \left[0, \frac{1}{2}\right]$. Intuitively, if the politicians belong to the same party ($\phi = S$), the voter adopts a coattail voting rule under which the incumbents' reelection outcomes are positively correlated: the good performance of one incumbent tends to prop up (while the poor performance drags down) her incumbent partisan ally in the other election. As a result, the incumbents are more likely to be reelected together or dismissed together than they are to receive opposite rewards. Thus, the partisanly aligned candidates are more likely to be elected at both branches of government. If the incumbents are members of different parties ($\phi = D$), then the voter uses a coattail voting rule under which their reelection outcomes are negatively correlated: the good performance of one incumbent increases (while the poor performance decreases) the opponent's chances to win in the other election. Thus, it is more likely that one incumbent will be dismissed while the other is reelected, and again the partisanly aligned candidates are more likely to be elected at both branches of government. To confirm this intuition, in Figure 3 I depict the politicians' reelection outcomes under equilibrium rules β_E^ϕ and β_C^ϕ in the two-dimensional space of performances p_E and p_C. The density function of the joint distribution of p_E and p_C is symmetric around (a_E^*, a_C^*).

The probability of election of politicians from the same party, $P_{\phi S}$ is increasing in λ_E and λ_C. This probability takes its maximal value of 1 when $\lambda_E = \lambda_C = 1$, and its minimal value of $\frac{1}{2}$ when $\lambda_E = \lambda_C = 0$. Intuitively, the more aligned politicians are to their parties, the more correlated (positively if $\phi = S$ or negatively if $\phi = D$) the optimal performance evaluation rules. The election of partisanly aligned candidates is more probable in both states, as explained above, so stronger party alignment just increases the probability of this outcome. Note furthermore that this probability does not vary across the states due to the symmetry of the politicians' preferences (which in turn implies the symmetry of performance evaluation rules the voter adopts in equilibrium).

3.4. Discussion

The results above show that coattail voting is in fact a tool that the voter uses to discipline partisan politicians. The model generates both presidential and reverse coattails. Since the executive wants her party to be presented in the legislature, in order to give her extra incentives the voter adopts a coattail voting rule such that the executive's good performance promotes the election of her partisan ally in congressional election. As a result, the presiden-

tial coattails arise. In turn, the congressman's partisan preferences lead to reverse coattail effect. The voter rewards or punishes the executive for the congressman's performance in order to incentify the latter who wants to increase his party chances to win presidential office.

I must stress that in the model coattail effects arise only if politicians are aligned with their political parties (in the sense that they want their party to win at both branches of government). So it is important to reason the assumption on partisan preferences of politicians at different levels of government. The literature on allocation of intergovernmental transfers provides support to this assumption. According to Cox and McCubbins (1986), the incumbents may use intergovernmental transfers to increase their reelection probability by allocating the funds to the districts with their supporters. The alignment between the two levels of government thus increases the amount of transfers because the central government favors its partisan allies and penalizes its partisan rivals. The recent empirical literature provides evidence in favor of this hypothesis (Arulampalam et al. 2009 (India), Brollo and Nannicini 2010 (Brazil), Larcinese et al. 2006 (the United States), Rozevitch and Weiss 1993 (Israel), Solé-Ollé and Sorribas-Navarro 2008 (Spain), Veiga and Pinho 2007 (Portugal)). Then the assumption on the partisan preferences of politicians is more than reasonable. On the one hand, lower-tier politicians prefer their partisan ally to take presidential office in hope to receive more generous transfers. On the other hand, the executive allocates more funds to the districts governed by her partisan allies exactly because she wants lower-tier politicians to be aligned with the central government. And she wants it "either because local politicians are important opinion leaders and they may turn to be useful allies in the next presidential campaign, or because they may engage in rent-seeking activities for the President."[18]

4. Conclusion

This paper studies coattail effects in simultaneous presidential and congressional elections. In a political agency model with moral hazard, coattail voting is an additional tool that voters use to motivate the politicians' efforts.

I assume that the politicians' incentives are correlated, as an executive/congressman prefers her counterpart (the congressman/executive) to be affiliated with the same political party. A representative voter is therefore better off adopting a joint performance evaluation rule rather than an individual performance evaluation rule when deciding whether to reward the incumbents. Under a joint rule, I have shown that the reelection outcomes of politicians

[18] See Brollo and Nannicini (2010), p. 6.

from the same party should be positively correlated while the reelection outcomes of politicians from different parties are negatively correlated. The two-sided coattail effects therefore result. On the one hand, the presidential coattails arise, as the executive's success/failure props up/drags down a candidate from the same party in congressional election. On the other hand, the executive's reelection itself depends on the congressman's performance, which implies the reverse coattails.

I have focused on single task policies. However, in reality public policies pursue many goals. So it is of interest to study coattail voting under a more realistic assumption of multiple-task policy where the problem of effort allocation among tasks can create policy trade-offs. One can also add an adverse selection problem by assuming that the politician's performance is determined by effort and her privately known ability. I leave these tasks for future research.

Appendix

A. Proof of Proposition 1

Under linear performance evaluation rules (β_i, b_i) the probability of being reelected for office i is

$$Pr_i\left(a_i, a_j\right) = P\left(\left\{\varepsilon_i + \beta_i \varepsilon_j \geq b_i - a_i - \beta_i a_j\right\}\right) = 1 - F_{\varepsilon_i + \beta_i \varepsilon_j}\left(b_i - a_i - \beta_i a_j\right),$$

where noises ε_i and ε_j $(i, j \in \{E, C\},\ i \neq j)$ are independent normally distributed random variables, so by the convolution formula $\varepsilon_i + \beta_i \varepsilon_j \sim N\left(0, \left(1 + \beta_i^2\right)\sigma^2\right)$. Politician i's utility is

$$\Pi_i\left(a_i, a_j, \phi\right) - \frac{a_i^2}{2} =$$

$$\begin{cases} 1 - F_{\varepsilon_i + \beta_i \varepsilon_j}\left(b_i - a_i - \beta_i a_j\right) + \lambda_i \left(1 - F_{\varepsilon_j + \beta_j \varepsilon_i}\left(b_j - a_j - \beta_j a_i\right)\right) - \frac{a_i^2}{2} & \text{if} \quad \phi = S \\ 1 - F_{\varepsilon_i + \beta_i \varepsilon_j}\left(b_i - a_i - \beta_i a_j\right) + \lambda_i F_{\varepsilon_j + \beta_j \varepsilon_i}\left(b_j - a_j - \beta_j a_i\right) - \frac{a_i^2}{2} & \text{if} \quad \phi = D. \end{cases}$$

The first-order conditions with respect to actual effort a_i, taking (β_i, b_i) and $\left(\beta_j, b_j\right)$ as given, are

$$\begin{cases} f_{\varepsilon_i + \beta_i \varepsilon_j}\left(b_i - a_i - \beta_i a_j\right) + \lambda_i \beta_j f_{\varepsilon_j + \beta_j \varepsilon_i}\left(b_j - a_j - \beta_j a_i\right) - a_i = 0 & \text{if} \quad \phi = S \\ f_{\varepsilon_i + \beta_i \varepsilon_j}\left(b_i - a_i - \beta_i a_j\right) - \lambda_i \beta_j f_{\varepsilon_j + \beta_j \varepsilon_i}\left(b_j - a_j - \beta_j a_i\right) - a_i = 0 & \text{if} \quad \phi = D. \end{cases}$$

The second-order conditions are

$$\begin{cases} -f'_{\varepsilon_i + \beta_i \varepsilon_j}\left(b_i - a_i - \beta_i a_j\right) - \lambda_i \beta_j^2 f'_{\varepsilon_j + \beta_j \varepsilon_i}\left(b_j - a_j - \beta_j a_i\right) - 1 < 0 & \text{if} \quad \phi = S \\ -f'_{\varepsilon_i + \beta_i \varepsilon_j}\left(b_i - a_i - \beta_i a_j\right) + \lambda_i \beta_j^2 f_{\varepsilon_j + \beta_j \varepsilon_i}\left(b_j - a_j - \beta_j a_i\right) - 1 < 0 & \text{if} \quad \phi = D. \end{cases} \tag{A.1}$$

Define the best response functions by $R_i : [0, \overline{a}] \to [0, \overline{a}]$ such that

$$R_i^{\phi}(a_j) = \arg \max_{a_i \in [0,\overline{a}]} \Pi_i(a_i, a_j, \phi) - \frac{a_i^2}{2}.$$

Then the best response functions are determined implicitly by the first-order conditions

$$\begin{cases} f_{\varepsilon_i+\beta_i\varepsilon_j}\left(b_i - R_i^{\phi}(a_j) - \beta_i a_j\right) + \lambda_i\beta_j f_{\varepsilon_j+\beta_j\varepsilon_i}\left(b_j - a_j - \beta_j R_i^{\phi}(a_j)\right) - R_i^{\phi}(a_j) = 0 & \text{if} \quad \phi = S \\ f_{\varepsilon_i+\beta_i\varepsilon_j}\left(b_i - R_i^{\phi}(a_j) - \beta_i a_j\right) - \lambda_i\beta_j f_{\varepsilon_j+\beta_j\varepsilon_i}\left(b_j - a_j - \beta_j R_i^{\phi}(a_j)\right) - R_i^{\phi}(a_j) = 0 & \text{if} \quad \phi = D. \end{cases}$$

Since $\Pi_i(a_i, a_j, \phi) - \frac{a_i^2}{2}$ is continuous, $R_i^{\phi}(a_j)$ is continuous. Therefore, a composite function $R_i^{\phi} \circ R_j^{\phi} : [0, \overline{a}] \to [0, \overline{a}]$ (defined as $\left(R_i^{\phi} \circ R_j^{\phi}\right)(a_i) = R_i^{\phi}\left(R_j^{\phi}(a_i)\right)$) is a continuous function from $[0, \overline{a}]$ into itself, where $[0, \overline{a}]$ is a nonempty, compact, convex set. Then by Brouwer's Fixed Point Theorem, $R_i^{\phi} \circ R_j^{\phi}$ has a fixed point; that is, there exists $a_i^{\phi} \in [0, \overline{a}]$ such that $a_i^{\phi} = \left(R_i^{\phi} \circ R_j^{\phi}\right)\left(a_i^{\phi}\right)$. So there exists a profile $\left(a_E^{\phi}, a_C^{\phi}\right)$ such that $a_E^{\phi} = R_E^{\phi}\left(a_C^{\phi}\right)$ and $a_C^{\phi} = R_C^{\phi}\left(a_E^{\phi}\right)$. This implies that $\left(a_E^{\phi}, a_C^{\phi}\right)$ is such that

$$\Pi_i\left(a_i^{\phi}, a_j^{\phi}, \phi\right) - \frac{a_i^{\phi 2}}{2} = \max_{a_i \in [0,\overline{a}]} \Pi_i\left(a_i, a_j^{\phi}, \phi\right) - \frac{a_i^2}{2}$$

where $i, j \in \{E, C\}$, $i \neq j$. Thus, $\left(a_E^{\phi}, a_C^{\phi}\right)$ is an equilibrium in effort strategies if it satisfies the second-order conditions (A.1), which completes the proof.

B. Proof of Proposition 2

The voter chooses (β_E, b_E) and (β_C, b_C) to maximize

$$a_E^{\phi} + a_C^{\phi} =$$

$$\begin{cases} (1 + \lambda_C\beta_E) f_{\varepsilon_E+\beta_E\varepsilon_C}\left(b_E - a_E^{\phi} - \beta_E a_C^{\phi}\right) + (1 + \lambda_E\beta_C) f_{\varepsilon_C+\beta_C\varepsilon_E}\left(b_C - a_C^{\phi} - \beta_C a_E^{\phi}\right) & \text{if} \quad \phi = S \\ (1 - \lambda_C\beta_E) f_{\varepsilon_E+\beta_E\varepsilon_C}\left(b_E - a_E^{\phi} - \beta_E a_C^{\phi}\right) + (1 - \lambda_E\beta_C) f_{\varepsilon_C+\beta_C\varepsilon_E}\left(b_C - a_C^{\phi} - \beta_C a_E^{\phi}\right) & \text{if} \quad \phi = D. \end{cases}$$

The implicit function theorem can be used to show that

$$\begin{aligned} b_E &= a_E^{\phi} + \beta_E a_C^{\phi}, \\ b_C &= a_C^{\phi} + \beta_C a_E^{\phi} \end{aligned}$$

maximize $a_E^{\phi} + a_C^{\phi}$ in state $\phi = S$, and maximize $a_E^{\phi} + a_C^{\phi}$ in state $\phi = D$ if $1 - \lambda_j\beta_i \geq 0$, $i, j \in \{E, C\}$, $i \neq j$. This yields

$$a_E^{\phi} + a_C^{\phi} = \begin{cases} \frac{1}{\sqrt{2\pi}\sigma}\left(\frac{1+\lambda_C\beta_E}{\sqrt{1+\beta_E^2}} + \frac{1+\lambda_E\beta_C}{\sqrt{1+\beta_C^2}}\right) & \text{if} \quad \phi = S \\ \frac{1}{\sqrt{2\pi}\sigma}\left(\frac{1-\lambda_C\beta_E}{\sqrt{1+\beta_E^2}} + \frac{1-\lambda_E\beta_C}{\sqrt{1+\beta_C^2}}\right) & \text{if} \quad \phi = D. \end{cases}$$

Maximizing $a_E^\phi + a_C^\phi$ with respect to β_E and β_C yields the slopes of equilibrium performance evaluation rules

$$\beta_i^\phi = \begin{cases} \lambda_j & \text{if} \quad \phi = S \\ -\lambda_j & \text{if} \quad \phi = D, \end{cases}$$

where $i, j \in \{E, C\}$, $i \neq j$. Note that in state $\phi = D$ the condition $1 - \lambda_j \beta_i^D \geq 0$ is satisfied. Therefore the intercepts of equilibrium performance evaluation rules are given by

$$b_i^\phi = \begin{cases} a_i^* + \lambda_j a_j^* & \text{if} \quad \phi = S \\ a_i^* - \lambda_j a_j^* & \text{if} \quad \phi = D, \end{cases}$$

where $a_i^* = a_i^\phi \left(\beta_E^\phi, b_E^\phi, \beta_C^\phi, b_C^\phi\right)$ is the politicians' equilibrium efforts, which do not depend on the current state ϕ. The rest of the proof is straightforward.

C. Proof of Proposition 3

The reelection of incumbent i is determined by random variable $\varepsilon_i + \beta_i \varepsilon_j \sim N\left(0, \left(1 + \beta_i^2\right)\sigma^2\right)$, $i, j \in \{E, C\}$, $i \neq j$. The density function of bivariate normal distribution of random variables $\varepsilon_E + \beta_E \varepsilon_C$ and $\varepsilon_C + \beta_C \varepsilon_E$, denoted by $f_{\varepsilon_E + \beta_E \varepsilon_C, \varepsilon_C + \beta_C \varepsilon_E}(x, y)$, is

$$f_{\varepsilon_E + \beta_E \varepsilon_C, \varepsilon_C + \beta_C \varepsilon_E}(x, y) = \frac{1}{2\pi\sigma^2 \sqrt{\left(\beta_E \beta_C - 1\right)^2}} \exp\left\{-\frac{\left(x - y\beta_E\right)^2 + \left(y - x\beta_C\right)^2}{2\sigma^2 \left(\beta_E \beta_C - 1\right)^2}\right\}.$$

In state $\phi = S$, partisanly aligned candidates are elected either when both incumbents are reappointed or when none of them is reappointed (so, opponents from rival parties are elected). Denote by $p_i^* = a_i^* + \varepsilon_i$ the performance of politician i in equilibrium. The equilibrium election probabilities in state $\phi = S$ are given by

$$\begin{aligned} P_{SS} &= P\left(\left\{p_E^* + \lambda_C p_C^* \geq a_E^* + \lambda_C a_C^*\right\} \cap \left\{p_C^* + \lambda_E p_E^* \geq a_C^* + \lambda_E a_E^*\right\}\right) + \\ &\quad P\left(\left\{p_E^* + \lambda_C p_C^* < a_E^* + \lambda_C a_C^*\right\} \cap \left\{p_C^* + \lambda_E p_E^* < a_C^* + \lambda_E a_E^*\right\}\right) = \\ &\quad P\left(\left\{\varepsilon_E + \lambda_C \varepsilon_C \geq 0\right\} \cap \left\{\varepsilon_C + \lambda_E \varepsilon_E \geq 0\right\}\right) + \\ &\quad P\left(\left\{\varepsilon_E + \lambda_C \varepsilon_C < 0\right\} \cap \left\{\varepsilon_C + \lambda_E \varepsilon_E < 0\right\}\right) = \\ &\quad \int_0^{+\infty}\int_0^{+\infty} f_{\varepsilon_E + \lambda_C \varepsilon_C, \varepsilon_C + \lambda_E \varepsilon_E}(x, y)\, dxdy + \int_{-\infty}^{0}\int_{-\infty}^{0} f_{\varepsilon_E + \lambda_C \varepsilon_C, \varepsilon_C + \lambda_E \varepsilon_E}(x, y)\, dxdy = \\ &\quad \tfrac{1}{2} + \tfrac{1}{\pi}\left(\arctan \lambda_E + \arctan \lambda_C\right), \end{aligned}$$

$$P_{SD} = 1 - P_{SS} = \tfrac{1}{2} - \tfrac{1}{\pi}\left(\arctan \lambda_E + \arctan \lambda_C\right).$$

In state $\phi = D$, candidates from different parties are elected when both incumbents are reappointed or when none of them is reappointed. The equilibrium election probabilities in state $\phi = D$ are given by

$$\begin{aligned} P_{DD} &= P\left(\{p_E^* - \lambda_C p_C^* \geq a_E^* - \lambda_C a_C^*\} \cap \{p_C^* - \lambda_E p_E^* \geq a_C^* - \lambda_E a_E^*\}\right) + \\ &\quad P\left(\{p_E^* - \lambda_C p_C^* < a_E^* - \lambda_C a_C^*\} \cap \{p_C^* - \lambda_E p_E^* < a_C^* - \lambda_E a_E^*\}\right) = \\ &\quad P\left(\{\varepsilon_E - \lambda_C \varepsilon_C \geq 0\} \cap \{\varepsilon_C - \lambda_E \varepsilon_E \geq 0\}\right) + \\ &\quad P\left(\{\varepsilon_E - \lambda_C \varepsilon_C < 0\} \cap \{\varepsilon_C - \lambda_E \varepsilon_E < 0\}\right) = \\ &\quad \int_0^{+\infty}\int_0^{+\infty} f_{\varepsilon_E - \lambda_C \varepsilon_C, \varepsilon_C - \lambda_E \varepsilon_E}(x,y)\, dxdy + \int_{-\infty}^{0}\int_{-\infty}^{0} f_{\varepsilon_E - \lambda_C \varepsilon_C, \varepsilon_C - \lambda_E \varepsilon_E}(x,y)\, dxdy = \\ &\quad \tfrac{1}{2} - \tfrac{1}{\pi}\left(\arctan \lambda_E + \arctan \lambda_C\right), \end{aligned}$$

$$P_{DS} = 1 - P_{DD} = \tfrac{1}{2} + \tfrac{1}{\pi}\left(\arctan \lambda_E + \arctan \lambda_C\right),$$

where $\arctan(\cdot)$ is an arctangent function.

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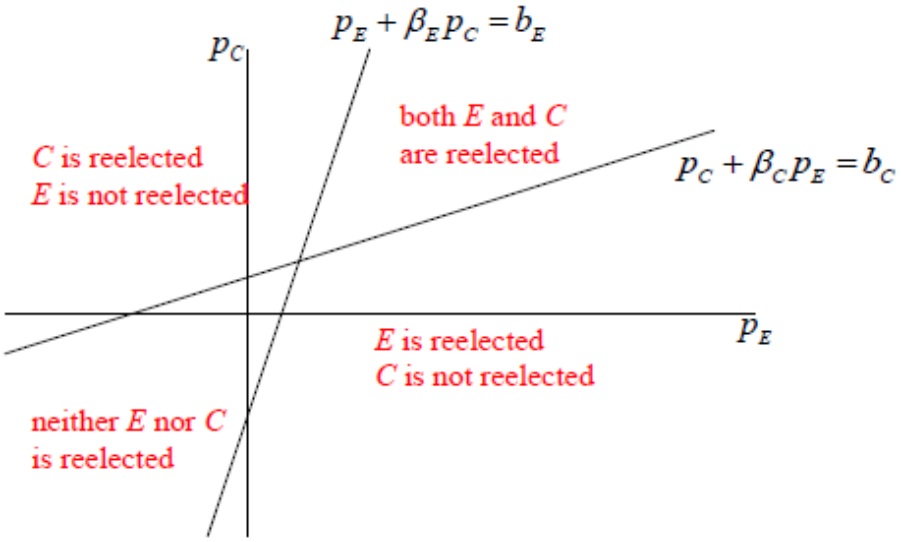

Figure 1: Executive E's and congressman C's reelection outcomes under linear rules (β_E, b_E) and (β_C, b_C) in the two-dimensional space of performances p_E and p_C.

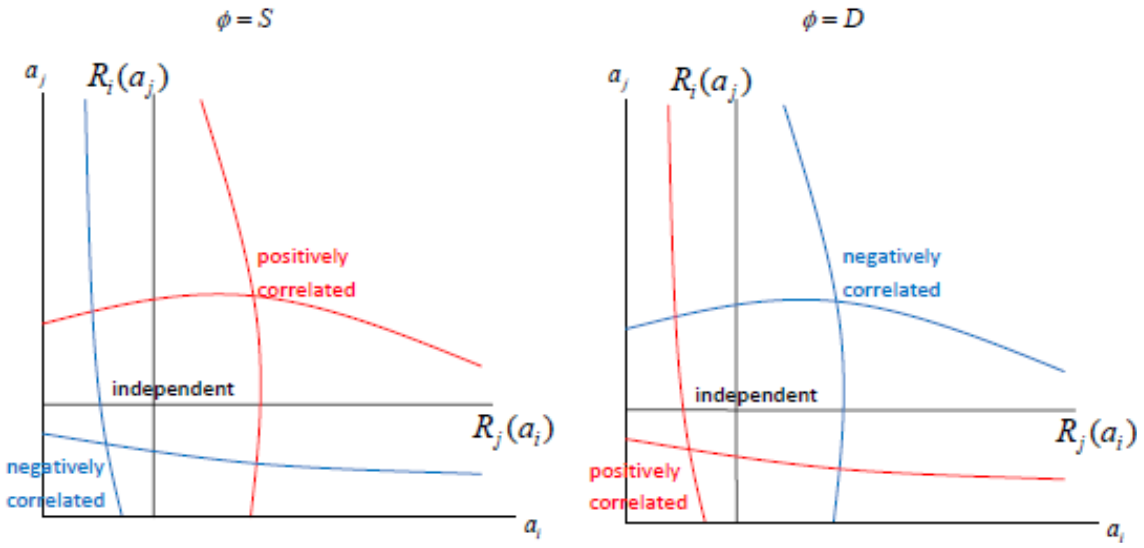

Figure 2: Best response functions of politicians i and j for independent reelections (black), positively correlated reelections (red) and negatively correlated reelections (blue) in states $\phi = S$ and $\phi = D$.

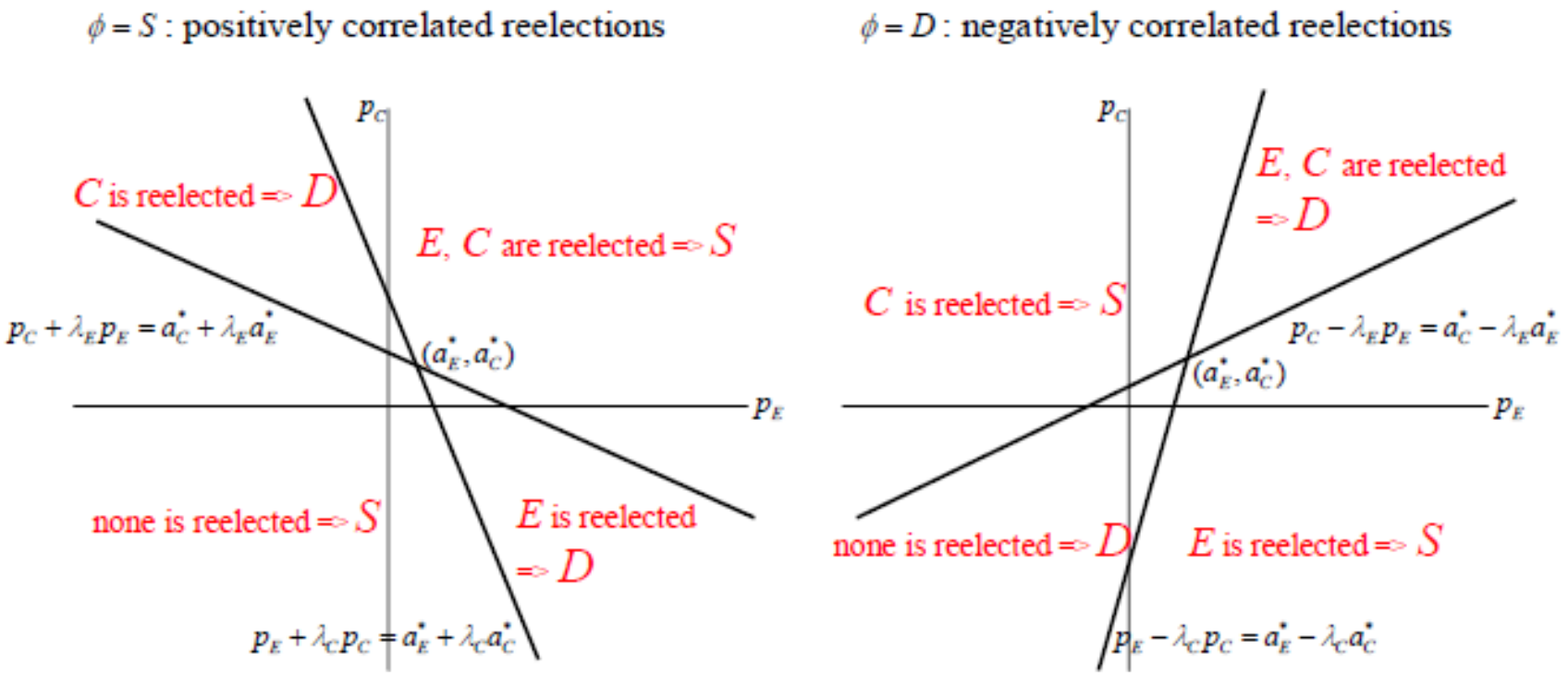

Figure 3: Politicians' reelection outcomes under equilibrium rules $\left(\beta_E^\phi, b_E^\phi\right)$ and $\left(\beta_C^\phi, b_C^\phi\right)$ in states $\phi = S$ and $\phi = D$.