Estimating Dynamic Games of Electoral Competition to Evaluate Term Limits in U.S. Gubernatorial Elections*

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Abstract

The objective of this paper is to estimate a dynamic game of electoral competition and to evaluate the role that term limits play in gubernatorial elections. In our model candidates from two parties compete in a sequence of statewide elections. Candidates differ in their ideological positions and competence. Both dimensions are initially unobserved, but are revealed through observed incumbents’ behavior. We design and implement a semi-parametric estimator and find strong evidence in favor of policy moderation. Moreover, we find significant costs associated with reelecting an incumbent. As a consequence, term limits can be welfare improving despite the fact that they increase policy volatility and force some qualified governors out of office.

KEYWORDS: Identification of dynamic games, semi-parametric estimation, electoral competition, term limits, welfare analysis, gubernatorial elections, institutional design.
1 Introduction

Elections serve an important function in modern democracies by allowing voters to express their support for politicians that share their ideological views and pursue policies preferred by voters. In addition, elections provide voters the opportunity to remove from office incumbents that cannot competently perform the duties of the office. During the last decade, much progress has been made in modeling electoral competition as a dynamic game of repeated elections.\(^1\) One important qualitative finding of the theoretical literature is that the institutional design of election rules can have a large impact on election outcomes and voters’ welfare. Few attempts have been made to quantify these effects. This paper makes two significant contributions to this literature. First, we show that a class of dynamic games with perfect monitoring is identified and can be estimated using standard semi-parametric techniques. Second, and more importantly, our paper provides the first careful, quantitative evaluation of the welfare effects of term limits. Our analysis characterizes the opposing effects of term limits and quantifies their relative importance. We provide a detailed characterization of conditions under which term limits may be welfare improving. The paper thus adds to our understanding of an important and controversial electoral institution that plays a prominent role in U.S. gubernatorial and presidential elections.

Following Duggan (2000), we consider a model of electoral competition among two political parties. Candidates differ in their ideology as well as their competence. There is a sequence of elections, and incumbents face a binding two-term limit. An election pits either two untested candidates against one another or an incumbent against an untested challenger. A key assumption is that a politician cannot credibly commit to an ideological platform prior to an election. An elected politician, therefore, has a tendency to implement policies that are in line with his or her ideology once in office (Osborne and Slivinski, 1996, Besley and Coate, 1996). Early papers that focus on political control are Barro (1973), Ferejon (1986) and Banks and Sundaram (1998). A recent survey of this literature is given by Duggan and Martinelli (2014).
1997). Policy moderation only arises due to the desire to be reelected.

Voters cannot observe ideology or the competence (valence) of an untested politician who has not served in office. Priors for these politicians depend solely on the candidates’ party. Each governor perfectly reveals his or her competence during the first term in office. Voters also observe the ideological platform implemented by the governor. This endogenously chosen ideological platform may differ from the exogenous ideology because of the desire of the politician to get reelected.

The chosen ideological platform serves as a signal regarding the incumbent’s unobserved ideological type. Voters update their beliefs based on the observed platform and competence and vote accordingly. Our model differs from most previous dynamic games of electoral competition by allowing for two parties with different distributions of ideological positions, but with a large common support. Hence, equilibria are not symmetric with respect to both parties. There are fiscal liberals and conservatives in both parties. Not surprisingly, we find in our empirical analysis that Republicans tend to be more fiscally conservative, on average, than Democrats. In contrast, we do not find any evidence for differences in the distribution of competence among the two parties.

We define and characterize a Perfect Bayesian Equilibrium of the dynamic game. We provide conditions so that our model generates unique reelection standards for both parties. These election standards imply ideological thresholds which characterize politicians’ strategies. Politicians from each party can be characterized as belonging to one of three groups. Centrists always implement their preferred ideological platform and are reelected to a second term. Extremists also implement their preferred ideological platform in the first period, but are not reelected to a second term. Term limits do not have a direct impact on these types of politicians. The third group of politicians are Moderates. They have incentives to moderate their ideological platform in the first term to win reelection to a second term. The election standards also depend on the competence of the incumbent. Voters are willing to reelect more extreme politicians as long as they are more competent.
The first objective of this paper is to establish identification of the model and develop a feasible semi-parametric estimation strategy.\(^2\) One empirical challenge is that both ideology and competence are latent from the perspective of the econometrician. The key idea is that we need to map the unobserved ability and ideological platform of a politician into policies that are observed by the econometrician. Identification of the distribution of ideology then rests on the key property of the model that extremists implement their preferred ideology during the first term and all re-elected politicians implement their preferred ideology during the second term due to term limits. To disentangle the effects of ability from the effects of ideology on observed policy, we also need to invoke an exclusion restriction and assume that a subset of observed policies, such as taxes, expenditures, or minimum wages, are only functions of ideology. Under these assumptions, we can identify the distributions of ability and ideology form the observed joint distribution of policies using standard results from latent factor models developed by Carneiro, Hansen, and Heckman (2003) and Cunha, Heckman, and Schennach (2010). We implement this procedure separately for each party, thus identifying the distributions of for Democratic and Republican candidates as well as the distributions of measurement or implementation error.\(^3\)

We then show that the remaining parameters are identified. The basic intuition is that we can use the observed probabilities of extremism in each party (conditional on observed


\(^3\)Differences between ideology and observed outcomes may arise due to the complexities of the legislative process or shocks during the implementation process.
policies), the observed degree of policy moderation between the two terms, together with the equilibrium properties of the model to identify the benefits that candidates from each party assign to holding office, the costs of reelecting incumbents, and the relative importance of competence in voters’ preferences. Finally, we show how to identify the underlying distribution of voter preferences based on the observed vote shares of incumbents (conditional on observed policies) that are reelected to a second term. Our proofs of identification are constructive and can be used to design a semi-parametric estimator of our model.\footnote{Our paper is related to growing literature in econometrics that studies identification and estimation of dynamic games. Some recent methodological papers include Pakes, Ostrovsky, and Berry (2007), Bajari, Benkard, and Levin (2007), Aguirregabiria and Mira (2007), and Pesendorfer and Schmidt-Dengler (2008), Merlo and Tang (2012), and Hu and Shum (2013). As discussed in detail below, our model and our approach towards semi-parametric identification and estimation differs significantly from these papers.}

The second objective of the paper is to provide a new comprehensive evaluation of the role that term limits play in gubernatorial elections in the U.S. Our data set consists of all elections held between 1950 and 2012. Implementing our semi-parametric estimator we find that the benefits from holding office are significant and large in economic magnitude. As a consequence, the prospects of reelection provide strong incentives for moderate governors to move towards the center of the ideological spectrum during their first term in office. Voters are willing to accept significant trade-offs in ideology to obtain a more competent governor.

The key parameter for evaluating term limits is the cost of reelecting incumbents. Advocates of term limits often argue that incumbents are less in touch with electorate or more influenced by party politics. In addition, incumbents may devote too much energy to fundraising activities or building up relationships with political insiders and lobbyists. We find that the costs of reelecting incumbents are statistically and economically significant.

We conduct three policy experiments to evaluate the desirability of term limits. In each policy experiment we compute aggregate voters’ welfare in a model with and without term limits. In the first policy experiment, we assume that the costs of reelecting an incumbent in
a model without term limits are equal to the costs estimated in our model with term limits. This comparison is likely to provide a lower bound of the welfare gains associated with term limits. Implementing this approach, we find that term limits reduce welfare by approximately 8 percent.

Incumbents have even stronger incentives in a world without term limits to build longterm relationships with insiders and lobbyists since these relationships are likely to last much longer and thus yield higher pay-offs to incumbents. It is thus plausible that the costs of reelecting incumbents are even larger when term limits do not exist. In the second experiment we ask how high the costs have to be for term limits to be welfare improving. We find that increasing the costs by 80 percent is sufficient for term limits to be welfare improving. In the third experiment we increase the costs of reelecting incumbents in both the model with and without term limits. In the symmetric case, we find that term limits are also welfare improving if costs are approximately 2.5 times our estimates.

To gain a better understanding of the impact of term limits on voters’ welfare, it is also useful to consider the differential effects of term limits on public policies. Term limit reduces welfare for two reasons. First, term-limited governors have no incentives to moderate in their last term policies. Second, some qualified politicians such as centrist or high ability governors are removed from office despite the fact that voter would prefer to reelect them.

Term limits potentially increase welfare since incumbents have fewer incentives to invest into longterm relationships with political insiders and lobbyists, and as a consequence potentially lower the costs of reelecting an incumbent for a second term. Moreover, this commitment is only for one more term, while the commitment is potentially much longer if term limits do not exist. These two effects improve voters’ welfare.

To our knowledge our paper is the first careful, quantitative welfare analysis of term limits that takes these opposing effects into consideration. Our findings are consistent with the broader assessment that term limits appear to be desirable if incumbents can easily build
large campaign war chests, invest in longterm relationships with special interest groups, and are, therefore, more likely to be disconnected from the voters. More research is clearly needed in this area, but our analysis suggests that term limits appear to be reasonable if these conditions are met.

Before we turn to our analysis, we offer a few more observations regarding the related literature in political economy. Downs (1957) developed the canonical theoretical model of a single election in which candidates can commit to policies prior to an election. Alesina (1988) extends the basic static framework and considers a repeated election model with two candidates. An alternative approach to the Downsian approach is based on the citizen-candidate literature, which goes back to Osborne and Slivinski (1996) and Besley and Coate (1997). These models are based on the notion that candidates cannot commit to policies prior to an election. Most of the citizen-candidate literature focuses on one-shot elections. Duggan (2000) introduced repeated elections into a citizen-candidate model with asymmetric information. This model was extended to account for term limits by Bernhardt, Dubey, and Hughson (2004). Bernhardt, Camara, and Squintani (2011) consider the trade-off between competence and ideology in a dynamic model without term limits. These models provide the basic framework that we estimate in this paper. We allow for asymmetries in the underlying distributions of ideology of candidates from the two competing parties. As a consequence, equilibria are not symmetric. Duggan and Fey (2006) consider repeated elections within a Downsian model and office motivated candidates. Benefits of holding office play a role in our model as well. Banks and Duggan (2008) consider repeated elections when the policy space is multi-dimensional. They characterize the set of equilibria in simple voting and policy strategies. Aragones, Palfrey, and Postelwaite (2007) also consider a repeated election model with two candidates, but allow for reputation effects which lead to policy moderation in equilibrium. To our knowledge, this is the first paper that has shown how to identify and estimate these types of dynamic games.

A related literature deals with the trade-off between moral hazard (accountability) and
adverse selection (competence) in elections.\textsuperscript{5} These models are based on the notation that “good” politicians need to exert effort to convince voters that they are competent. These models also give rise to election standards that are used by voters to provide incentives for politicians.\textsuperscript{6} We focus on the adverse selection problem and abstract from the effort decision treating ideology as a predetermined, but initially unobserved source of heterogeneity. Aruoba, Drazen, and Vlaicu (2015) estimate a structural model of electoral accountability. They find a strong incentive effect of elections, and a somewhat weaker selection effect.

The seminal empirical paper on term limits is Besley and Case (1995). They consider two different agency models with term limits. The empirical analysis is based on a fixed effect panel data estimator using U.S. data from gubernatorial election from 1950-1986. (Besley and Case (2003) extends the analysis to the mid 1990’s.) They show that term limits affect policy choices as predicted by the model we estimate. As we discuss in detail below, their results are consistent with our approach and our findings. Another prominent empirical paper on term limits is Daniel and Lott (1997) who provide evidence that term limits increase the probability that incumbents lose elections. This finding is also consistent with our model. Stone and Simas (2010) discuss the empirical literature that has analyzed the relationship between valence and ideology. Most of the empirical studies focus on federal elections.

The rest of the paper is organized as follows. Section 2 presents a dynamic game of electoral competition. Section 3 discusses identification and estimation. Section 4 introduces our data set. Section 5 presents the empirical findings from our semi-parametric estimator. Section 6 focuses on measuring the welfare effects of term limits. We offer conclusions in Section 7.

\textsuperscript{5}See, for example, Banks and Sundaram (1998), Maskin and Tirole (2004), Ashworth (2005), and Gowrisankaran, Mitchell, and Moro (2008).

\textsuperscript{6}For a recent discussion of the related empirical literature see Alt, Bueno de Mesquita, and Rose (2011).
2 A Dynamic Game of Electoral Competition

Building on Duggan (2000), Bernhardt, Dubey, and Hughson (2004), and Bernhardt, Camara, and Squintani (2011), we consider a dynamic game that captures the repeated elections of a governor in a state that has adopted a two-term limit for the office holder. Politicians differ by ideology $\rho$, competence $a$, and incumbency status $i$. Each governor chooses and implements an ideological platform, denoted by $x$. This endogenously determined platform may be different from the exogenous true ideology, $\rho$, due to strategic moderation by the politician. An elected politician may adopt a more moderate ideological platform while in office that differs from his true ideology to win reelection. Policies, which are denoted by $p(a, x)$, are deterministic functions of the ideological platform taken in office, $x$ and ability $a$.$^7$

There is a continuum of infinitely lived voters that differ by their ideological location, $\theta \in \mathbb{R}$. Since the policy function, $p(a, x)$, is deterministic and known to the voters, it is sufficient to model preferences over $a$ and $x$. A voter’s flow utility, therefore, depends on the ideological platform that a governor implements when in office and the managerial ability or competence of the governor, and the incumbency status. Advocates of term limits often argue that incumbents are less in touch with the electorate or more influenced by party politics. In addition, incumbents may devote too much energy on fundraising activities or building up relationships with political insiders and lobbyists. To capture these costs associated with reelecting incumbents, we have adopted the following voter’s flow utility function:

$$u(\theta, a, x, i) = -|\theta - x| + \lambda a - \kappa i$$ (1)

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$^7$The policy function plays no direct role in the theoretical model. Flow utilities of voters and politicians are only a function of $a$ and $x$, although one can clearly interpret the flow utilities as the “reduced forms” of a similar model in which preferences are defined over $p(a, x)$. As long as the higher dimensional vector of policies are deterministic functions of $a$ and $x$, all the results presented in the paper can be extended. The distinction between policies and ideological platforms is important from the perspective of identification as discussed in detail in Section 4.
where \( i \) is an indicator that is equal to one if the governor is in his or her second term and zero otherwise. The last term of the flow utility, \( \kappa i \), reflects the costs of reelecting an incumbent. If these costs are sufficiently large, term limits can be beneficial to society.

The distribution function of voters’ preferences in the society is given by \( F_\theta(\cdot) \). The median voter is located at \( \theta = 0 \). Voters share a common discount factor, denoted by \( \beta \), are forward looking, and maximize life-time utility.

A politician’s flow utility depends on the benefits of being in office and the ideological platform that is implemented in office. A governor with ideology \( \rho \) and competence \( a \) who locates at \( x \) derives period utility

\[
v(\rho, a, x) = -|\rho - x| + \lambda a + \psi
\]

where \( \psi > 0 \) captures the benefits from holding office.

We focus on the empirically relevant case where challengers are chosen by opposing parties, denoted by D and R.\(^8\) We assume that heterogeneity in ideology among politicians of party \( j \) is given by a distribution, denoted by \( F_\rho^j(\cdot) \). Moreover, the two distributions share a common support. As a consequence, there will be liberals and conservatives in both parties. We also assume that competence and candidate’s ideology are independently distributed. The distribution of ability is denoted by \( F_a^j(\cdot) \). Politicians have a discount factor, denoted by \( \gamma \), are forward looking, and maximize life-time utility.

The ideology of a politician, \( \rho \), is private information, not observed by other candidates or voters. Voters hold beliefs about ideologies, observe platforms, \( x \), and update beliefs about incumbents. The competence of a challenger is also initially private information. We assume that an elected governor reveals his or her competence to other candidates and voters during the first term. The competence of an incumbent seeking reelection is, thus, common knowledge.

\(^8\)In contrast to most previous papers we do not assume that party R (D) consists of all candidates with ideology \( \rho < 0 \) (\( \rho > 0 \)). Our empirical results indicate that this assumption is empirically not valid.
If there is no incumbent (such as the first period of the game), there is an election between two untried challengers, one from each party. Whenever two untried politician compete against each other in an election, the outcome is determined by a coin toss that elects a politician of party $D$ with probability $P_D$ which is endogenously determined as discussed below. The politician that wins the election then becomes the incumbent.

Consider the case in which a Republican has been elected to office for a first term in period $t$. The elected governor implements a ideological platform during his or her first term, denoted by $x_t$, which is observed by all voters. Governors also reveal their true ability during the first term in office. Voters update their beliefs about the ideological type and perfectly learn the competence of the incumbent.

At the beginning of period $t + 1$, the Republican incumbent with known competence $a$ then faces a challenger from party $D$ in an election. If the incumbent is reelected, he serves a second term in period $t + 1$. In period $t + 2$ there is an open election, since the incumbent cannot run for reelection. The game at the beginning of period $t + 2$ is exactly like the game at the beginning of period $t$. We focus on a stage-undominated Perfect Bayesian Equilibrium (PBE).

First term politicians have strategies, $\delta_j(\rho, a)$, that map ideology and competence into ideological platforms. These strategies are party specific. The history of past platforms for an incumbent that has served one period is given by $x_{t-1}$. An incumbent’s strategy is a function $\delta_j(\rho, a, x_{t-1})$ that assigns a ideological platform for each history, politician’s ideology, competence, and party, $j \in \{D, R\}$.

A voting strategy for an election with an established incumbent from party $j$ is given by a function $\alpha_j(\theta, x_{t-1}, a)$ that maps the voters type and the observed history and competence into the probability of voting for an incumbent that belongs to party $j$. We focus on anonymous sincere voting strategies, i.e. voting strategies that only depend on the incumbent’s personal

\[9^9\text{The voting strategy for open elections is a mixed strategy, i.e. a coin toss.}\]
history and party membership. Voting is sincere if

- \( \alpha_R(\theta, x_{t-1}, a) = 1 \) if voters prefer the Republican incumbent.

- \( \alpha_R(\theta, x_{t-1}, a) = 0 \) if voters strictly prefer the Democratic challenger.

Similarly, we can define voting strategies if the incumbent is a Democrat. Voters do not use weakly dominated strategies that hinge on the fact that a voter is not pivotal.

Voter beliefs about a Republican incumbent’s ideology for all possible histories are given by the common belief function \( P_R(\rho|x_{t-1}, a) \) which is the cumulative probability that a Republican incumbent has ideology less than \( \rho \) given the observed history \( x_{t-1} \) and competence, \( a \).

Consider a time period \( t \), which is the second period for an incumbent, i.e. the incumbent is term-limited. It is straightforward to show that a term-limited governor will implement his or her preferred ideological platform in the second period, \( x_t = \rho \).

Let \( V^o(\theta) \) denote the expected discounted utility of electing a new governor in an open election. Notice that this value function is time independent since it does not depend on the history of the game.

Let \( V^D(\theta) \) denote the expected discounted utility of electing a new governor from party \( D \). The expected discounted utility if a Republican incumbent is reelected to serve a second term is given by:

\[
V^{I,R}(\theta, x_{t-1}, a) = -E \left( |x_t - \theta| \mid x_{t-1}, a \right) + \lambda a - \kappa + \beta V^o(\theta) \tag{3}
\]

If the incumbent is a Republican, sincere voting then implies that

1. \( \alpha_R(\theta, x_{t-1}, a) = 1 \) if \( V^{I,R}(\theta, x_{t-1}, a) \geq V^D(\theta) \)

2. \( \alpha_R(\theta, x_{t-1}, a) = 0 \) if \( V^{I,R}(\theta, x_{t-1}, a) < V^D(\theta) \)
A similar condition holds for a Democratic incumbent.

**Definition 1** An equilibrium then consists of two strategy functions for voters (one for each party), two common belief functions, two strategies for untested politicians, and two strategies for incumbents, such that:

- the candidates maximize expected utility given their own ideology, competence, and voters’ strategies,
- the voters vote sincerely given the candidates’ and incumbents’ strategies,
- beliefs are consistent with candidates’ and incumbents’ strategies and updated according to Bayes’ Rule.

In equilibrium, voters adopt time invariant election standards for incumbents of each party that are given by $[s_j(a), \bar{s}_j(a)]$, $j \in \{D, R\}$. An incumbent with competence $a$ belonging to party $j$ is reelected if and only if the observed ideological platform in the first period in office is within the interval given by $[s_j(a), \bar{s}_j(a)]$.

Note that the resulting equilibrium is not necessarily symmetric, i.e. politicians from different parties face different election standards. Figure 1 illustrates the election standards and ideological thresholds that arise for each party using our estimated model. We plot the upper and lower election standard as a function of competence. Note that there are significant differences in election standards across parties. Moreover, both parties have a lower and upper threshold reflecting the fact that there are liberals and conservatives in each party.

The election standards then imply ideological thresholds for politicians which implicitly characterize politicians’ strategies. Let us define $\tilde{\rho}_R(a)$ such that:

$$ -|\tilde{\rho}_R(a) - \bar{s}_R(a)| + \gamma (\psi + \lambda a) = 0 $$ (4)
A Republican politician with ideology $\bar{\rho}_R(a)$ and competence $a$ is indifferent between implementing ideological platform $\bar{s}_R(a)$ and being reelected and implementing ideological platform $\bar{\rho}_R(a)$ and not being reelected. Similarly define

$$-|\rho_R(a) - \bar{s}_R(a)| + \gamma (\psi + \lambda a) = 0 \quad (5)$$

A Republican politician with ideology $\rho_R(a)$ is indifferent between implementing ideological platform $s_R(a)$ and being reelected and implementing ideological platform $\rho_R(a)$ and not being reelected. Note that we are implicitly normalizing the continuation pay-off of politicians that are not in office to be equal to zero.$^{10}$

Next consider a Republican politician that has competence $a$ and has just been elected

$^{10}$An alternative approach assumes that politicians are treated as citizen’s when not in office. In that case, there is an additional benefit from moderation since an incumbent can lower the probability that an opponent from the opposite party will win the election by forcing an open election in the following period to determine the successor. We estimate both versions of the model and discuss the differences in more detail in Section 6.
in period $t$ to serve his or her first term. The incumbent’s optimization problem implies the following decision rules:\footnote{The beliefs that support this equilibrium are given in Appendix B.}

- $\rho < \underline{\rho}_R(a)$ then $x_t = \rho$, expecting to lose reelection in $t + 1$.
- $\rho \in (\underline{\rho}_R(a), \underline{s}_R(a))$ then $x_t = \underline{s}_R(a)$, expecting to win reelection in $t + 1$.
- $\rho \in (\underline{s}_R(a), \bar{s}_R(a))$ then $x_t = \rho$, expecting to win reelection in $t + 1$.
- $\rho \in (\bar{s}_R(a), \bar{\rho}_R(a))$ then $x_t = \bar{s}_R(a)$, expecting to win reelection in $t + 1$.
- $\rho > \bar{\rho}_R(a)$ then $x_t = \rho$, expecting to lose reelection in $t + 1$.

Suppose that value functions satisfy a single-crossing property so that the median voter is decisive.\footnote{We discuss below how to verify this assumption.} A Republican incumbent that locates at $x_t = \underline{s}_R(a)$ will be reelected if the median voter prefers the incumbent to an untested challenger from the Democratic party. That holds, if and only if:

$$-E \left( \left| \rho \right| \left| \rho \in [\underline{\rho}_R(a), \underline{s}_R(a)] \right| \right) + \lambda a - \kappa + \beta V^o(0) \geq V^D(0)$$

Similarly, the median voter prefers the Republican incumbent at $x_t = \bar{s}_R(a)$ to the challenger from party $D$ if and only if

$$-E \left( \left| \rho \right| \left| \rho \in [\bar{s}_R(a), \bar{\rho}_R(a)] \right| \right) + \lambda a - \kappa + \beta V^o(0) \geq V^D(0)$$

Equilibrium also requires that the median voter does not prefer a politician that locates at $x_t = \underline{\rho}_R(a)$ to the challenger:

$$-|\underline{\rho}_R(a)| + \lambda a - \kappa + \beta V^o(0) \leq V^D(0)$$

Similarly, the median voter does not prefer a politician that locates at $x_t = \bar{\rho}_R(a)$ to the challenger:

$$-|\bar{\rho}_R(a)| + \lambda a - \kappa + \beta V^o(0) \leq V^D(0)$$
Here we will focus on equilibria with maximal sincere beliefs which satisfy:

\[-E \left( |\rho| \mid \rho \in [\underline{\rho}_R(a), \bar{\rho}_R(a)] \right) + \lambda a - \kappa + \beta V^o(0) = V^D(0) \quad (10)\]

\[-E \left( |\rho| \mid \rho \in [\bar{\rho}_R(a), \bar{\rho}_R(a)] \right) + \lambda a - \kappa + \beta V^o(0) = V^D(0) \quad (11)\]

Equations (4), (5), (10) and (11) then define election standards and ideological thresholds. Similarly, we can derive election standards for Democratic incumbents denoted by \( s_D(a) \) and \( \bar{s}_D(a) \), as well as thresholds \( \rho_D(a) \) and \( \bar{\rho}_D(a) \).

The value function of voter \( \theta \) for electing an untried Democratic challenger is given by the following expression:

\[
V^D(\theta) = \int_{A} \int_{-\infty}^{\rho_D(a)} -|\rho - \theta| + \lambda a + \beta V^R(\theta) \, dF^p_D(\rho) \, dF^a_D(a) \\
+ \int_{A} \int_{\rho_D(a)}^{s_D(a)} -s_D(a) - \theta + \lambda a + \beta(-|\rho - \theta| + \lambda a - \kappa) + \beta^2 V^o(\theta) \, dF^p_D(\rho) \, dF^a_D(a) \\
+ \int_{A} \int_{\bar{s}_D(a)}^{\rho_D(a)} (1 + \beta)(-|\rho - \theta| + \lambda a) - \beta \kappa + \beta^2 V^o(\theta) \, dF^p_D(\rho) \, dF^a_D(a) \\
+ \int_{A} \int_{\rho_D(a)}^{\infty} -|\rho - \theta| + \lambda a + \beta V^R(\theta) \, dF^p_D(\rho) \, dF^a_D(a)
\]

A similar equation holds for \( V^R(\theta) \). Note that we implicitly assume that an extremist runs for a second term, but loses the election and is replaced by candidates from the opposing party. As we discuss below, the empirical evidence supports this assumption.\(^{13} \)

Finally, we have:

\[
V^o(\theta) = P_D V^D(\theta) + (1 - P_D)V^R(\theta)
\]

To close the model, we assume that \( P_D \) – the probability that an untried Democrat wins an open election – is given by:

\[
P_D = \frac{\exp(V^D(0)/\sigma)}{\exp(V^D(0)/\sigma) + \exp(V^R(0)/\sigma)}
\]

\(^{13}\)Alternatively, we could assume that extremists do not run in the second period and the election is an open election or endogenize the decision to run.

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To finish the argument, we need to verify that the value functions satisfy a single-crossing condition in $\theta$ such that the median voter is in fact decisive. While we do not have a general proof for this result, we can numerically verify these conditions for each specification that we consider in estimation. To illustrate these issues, we plot the key value functions based on our parameter estimates.

First consider the case in which an incumbent is pitted against an untested challenger. Figure 2 plots the value functions associated with a Republican incumbent and an untested challenger from the Democratic party. We consider two interesting cases. The upper panel of Figure 2 plots $V^{I,R}(\theta, \bar{s}_R, a)$ which refers to the case when the last period platform was given by $x_{t-1} = \bar{s}_R(a)$. This is the case of a moderate conservative Republican. The lower panel of Figure 2 plots $V^{I,R}(\theta, \bar{s}_R, a)$, which refers to the case when the last period ideological platform was given by $x_{t-1} = \bar{s}_R(a)$. The incumbent is thus a moderate liberal Republican. By construction the two value functions intersect in both panels of Figure 2 at zero which is the location of the median voter. The median voter is, therefore, indifferent between reelecting the incumbent or electing the challenger. The two plotted value functions only intersect once and, thus, satisfy a single-crossing property. The set of voters who prefers the Republican incumbent is a connected set. As a consequence, the median voter at zero is decisive.

Formal proofs of the existence of equilibria in cut-off strategies are given, for example, by Bernhardt, Camara, and Squintani (2011), who consider a symmetric model without term limits, and Bernhardt, Dubey, and Hughson (2004), who consider a model with term limits but without heterogeneity in competence.
Figure 2: Value Functions: $V^{I,R}$ and $V^D$

![Graph of Value Functions](image)
3 Identification and Estimation

3.1 Identifying the Distributions of Ideology and Competence

Politicians are endowed with a level of competence, $a$ and ideology, $\rho$, both of these variables are not directly observed by the econometrician. There are three challenges in identifying the joint distribution of $a$ and $\rho$.

The first challenge arises because elected politicians endogenously adopt an ideological platform $x$. The endogenous ideological position $x$ may be different from the exogenous true ideology, $\rho$ due to strategic moderation by the politicians, i.e. an elected politician may chose an ideological position that differs form his true ideology to win reelection. This potentially creates a selection problem. The identification argument proposed in this paper rests on the key property of the model that extremists set $x = \rho$ in the first term and all re-elected politicians set $x = \rho$ in the second term due to term limits. This solves the potential selection problem.

The second challenge arises because $\rho$, $x$ and $a$ are not observed by the econometrician. The model is based on the informational assumption that voters observe the ideological platform implemented by the governor, $x$, as well as the competence, $a$ during the first term. However, we as econometricians do not observe $a$ or $x$. We thus assume that voters have a better information set than econometricians.\textsuperscript{14} The key idea to resolve the second challenge

\textsuperscript{14}This assumption is common in modern econometrics. For example, McFadden (1973) differentiates between observed and unobserved state variable to generate a well-behaved likelihood function for discrete choice models. Rust (1994) provides a detailed discussion of this assumption and provides a variety of alternative approaches that justify the assumption. Similar informational assumption underly almost all of modern structural econometrics in labor economics, industrial organization and public economics. Sometimes econometricians have the benefit of hindsight, but usually the econometrician's information set is much more limited than the one by the agents in the model. We discuss extending our approach to models with imperfect monitoring, in which voters and econometricians only observe $p = p(a, x) + \epsilon$ in the conclusions.
is that we map unobserved ability and ideological position of a politician \((a, x)\) into policies \(p\) that are observed by the econometrician. This mapping is given by a linear measurement system that can be written as \(p = p(a, x) + \epsilon\), where \(\epsilon\) can be interpreted as measurement error.

Finally, we need to disentangle the effects of ability from the effects of ideology on observed policies. To accomplish this we also need to invoke an exclusion restriction and assume that a subset of observed policies such as taxes, expenditures, and minimum wages are only functions of ideology. Under these assumptions we can identify the joint distribution of ability and ideology form the observed distribution of policies using standard results from latent factor models.

To formalize these ideas, we follow Carneiro, Hansen, and Heckman (2003) (CHH) and interpret the observed policy outcomes, denoted by \(p_i\), as noisy measures of two latent factors, \(x\) and \(a\).\(^{15}\) Suppose we observe five outcomes and assume that the function that maps \((a, x)\) into \(p\) can be written as follows:

\[
\begin{align*}
    p_1 &= x + \epsilon_1 \\
    p_2 &= \mu_{21} x + \epsilon_2 \\
    p_3 &= \mu_{31} x + a + \epsilon_3 \\
    p_4 &= \mu_{41} x + \mu_{42} a + \epsilon_4 \\
    p_5 &= \mu_{51} x + \mu_{52} a + \epsilon_5 
\end{align*}
\]  \hspace{1cm} (15)

Note that the normalizations in the first and third equation are necessary to impose a scaling on the latent factors. The exclusion restrictions require, that we have, at least, two outcomes that are primarily driven by \(x\) and do not depend on \(a\).

In our empirical analysis, we consider three such outcomes: expenditures per capita, taxes per capita, and minimum wages. These outcomes differentiate fiscal conservatives

\[^{15}\text{This line of research goes back to work by Anderson and Rubin (1956).}\]
from fiscal liberals. Ideology is, therefore, implicitly defined as differences in opinion about the preferred size of government. In addition, we observe additional outcomes that not just reflect ideology, but also depend on competence. Here we focus on measures such as workers compensations, state income growth, and state debt borrowing cost. We, therefore, implicitly define competence as the managerial ability of the governor to run important economic programs, to lower borrowing costs, and to generate economic growth.

We have seen that the implemented ideological platform \( x \) may not necessarily reflect the true ideology \( \rho \) of a governor. We do not observe \( \rho \), either. Due to the existence of term limits, only moderate first term governors engage in strategic moderation. We formalize the key identification results of our paper.

**Proposition 1** In equilibrium, the following two conditions hold:

1. Governors that only serve one term (i.e. that are not reelected to a second term) reveal their true ideological preferences in the first period.

2. Governors that serve two terms (i.e. that are successfully reelected to a second term) reveal their true ideological preferences in the second period due to the term limit.

Using the subpopulation that consists of policies enacted by one term governors and second term policies of reelected governors, we can identify the factor loading and the underlying distribution functions of ideology and competence.

The intuition behind this result is simple. In the sub-population described in Proposition 1 we have \( x = \rho \). Substituting this equation into the measurement system, we obtain for this
subpopulation:

\[
\begin{align*}
p_1 &= \rho + \epsilon_1 \\
p_2 &= \mu_2 \rho + \epsilon_2 \\
p_3 &= \mu_3 \rho + a + \epsilon_3 \\
p_4 &= \mu_4 \rho + \mu_4 a + \epsilon_4 \\
p_5 &= \mu_5 \rho + \mu_5 a + \epsilon_5
\end{align*}
\] (16)

The identification of the factor loadings directly follows from CHH. Moreover, Cunha, Heckman, and Schennach (2010) show that we obtain non-parametric identification of the distributions of \( \rho \) and \( a \) by repeatedly applying Kotlarski’s Theorem using a convenient transformation of the outcome measures.\(^{16}\) Appendix C summarizes the key insights of these papers and provides a proof of Proposition 1. Note that we can apply this methodology for each party separately, thus identifying the distributions of ideology and competence for each party.

### 3.2 Identifying the Preference Parameters

We also need to identify the remaining parameters of the model – the benefit of holding office (\( \psi \)), the cost of reelecting incumbents (\( \kappa \)), the preferences for ability (\( \lambda \)), and the standard deviation of the election shock (\( \sigma \)) – given that we have already identified the joint distribution of politician’s ability and ideology.\(^{17}\)

Note that we observe \( P_D \), the share of Democratic winners in open elections, which then identifies \( \sigma \) using equation (14). Identification of \( \lambda \) is fairly straightforward. The intuition is that an increase in \( \lambda \) (holding \( \kappa \) and \( \psi \) constant) decreases the probability of defeat for high ability politicians and increases the probability of defeat for low ability politicians. The

---

\(^{16}\)Estimating the distributions of ideology and competence requires the choice of tuning parameters. We follow the approach that is discussed in detail by Krasnokutskaya (2011).

\(^{17}\)We treat the annual discount factor of voters as known and set it equal to 0.95. The discount factor of politicians is set equal to one implying that politicians value both terms equally.
elections standards and cut-off rules become steeper functions of ability. While we do not directly observe ability, the exclusion restriction imposed above imply that we observe policies that are correlated with \(a\). The probability of electoral defeat conditional on observed policies that are correlated with ability thus identifies \(\lambda\).

Finally, it is more challenging to disentangle the benefits of holding office \(\psi\) from the costs of reelecting an incumbent \(\kappa\). The intuition behind the identification is the following. The benefit of holding office, \(\psi\), affects the ideological thresholds and hence the willingness of moderates to compromise. This follows from the fact that equations (4) and (5) include a linear term in \(\psi\).\(^{18}\) As a consequence \(\psi\) primarily affects the fraction of moderates relative to the fraction of centrists. The larger \(\psi\), the larger the difference of the variances of period 1 and period 2 policies. In contrast, \(\kappa\) primarily affects the election standards. This follows from the fact that equations (6) and (7) have linear term in \(\kappa\). As a consequence \(\kappa\) is primarily identified from the fraction of governors that are not reelected.

To formalize these arguments, fix the level of competence at level \(a\) and suppose, initially, that the econometrician observes \(a\). Equilibrium requires that equations (4), (5), (10) and (11) hold for each party. Given \((\kappa, \psi, \lambda)\), we find that the election standards \(s_j(a)\) and \(\bar{s}_j(a)\), \(j \in \{R, D\}\) and ideological thresholds are uniquely determined by these equations.\(^{19}\) In addition, the fraction of extremists in each party \(j\) conditional on \(a\) satisfies:

\[
Pr\{\text{Lose Reelection}|a, j\} - \left( F_{\rho_j}^{\rho}(\rho_j(a)) + 1 - F_{\bar{\rho}_j}^{\rho}(\bar{\rho}_j(a)) \right) = 0 \quad (17)
\]

Note that the first term of the equation above is identified if we observe \(a\). The second term is a known function of the three parameters \(\kappa, \psi, \lambda\).

Similarly, the model generates variances of policies for politicians that serve two terms denoted by \(Var_t(p|\kappa, \psi, \lambda)\) for term \(t = 1, 2\). Again these variances are observed in the data.

\(^{18}\)In addition, the value functions in equations (4) - (7) are functions of \(\lambda, \kappa, \text{and} \psi\).

\(^{19}\)Given that this system of equations is non-linear, uniqueness is not guaranteed. We find that it seems to hold for all parametric version of our model that we have explored.
Moreover, holding $\lambda$ and $\kappa$ fixed it is easy to verify that the difference in the variance is a monotonic function in $\psi$. We can construct additional moment conditions based on the difference between the observed and predicted variances.

Stacking all moment conditions, gives us a system of non-linear equations in $(\kappa, \psi, \lambda)$. These parameters are, therefore, identified if this system has a unique solution. For any finite sample, uniqueness of the solution can be numerically verified during estimation.

In practice $a$ is not directly observed by the econometrician, instead we observe a vector of policies $p$ that are correlated with $a$. As a consequence, attention focuses on the following moment condition:

$$E[Pr\{\text{Lose Reelection}|a,j|p\} - \int (F_j^p(s_j(a) - y) + 1 - F_j^p(\bar{s}_j(a) + y)) f(a|p) \, dp = 0 \tag{18}$$

Note that the first term in equation (18) is identified and can be consistently estimated for each value of $p$ based on the observed data. The second term is a known function of $\kappa, \psi, \lambda$. Finally, the results in Section 3.1. imply that $f(a|p)$ is non-parametrically identified.\(^{20}\)

Assuming again that the system of equations has a unique solution, we conclude that the parameters of interest are identified.

Finally, we can exploit the variation of the election probabilities and the difference in the variance of first and second term policies by party to identify an extended version of the model, in which the benefits of holding office, $\psi_j$, and the costs of reelecting incumbents, $\kappa_j$ are party-specific.

### 3.3 Identifying the Distribution of Voters’ Ideal Points

The distribution of voters’ ideological ideal points can be identified from the observed vote shares of incumbents that are reelected to a second term. The intuition is that there exists a

\(^{20}\)For example, from the third measurement equation, we have $a = p_3 - \mu_3 + \rho \epsilon_3$. Since $\rho$ and $\epsilon_3$ are independent, we can identify $f(a|p_3)$ using standard convolution methods.
one-to-one mapping between the vote share of the incumbent and the distribution of voters’ ideology conditional on ability. We do not observe ability, but we observed policies that are correlated with ability.

Again, we first consider the case in which \(a\) and \(x_{t-1}\) are observed without error by the econometrician. Consider a fiscally conservative Republican \((x_{t-1} \leq 0)\), and recall that the conditional value function associated with reelecting the incumbent of voter \(\theta\) is given by:

\[
V^{I,R}(\theta, x_{t-1}, a) = -E\left[|x_t - \theta| \bigg| x_{t-1}, a\right] + \lambda a - \kappa + \beta E[V^o(\theta)]
\] (19)

Let \(V^D(\theta)\) denote the conditional value function of electing an untested Democratic candidate. Given sincere voting, the set of individuals that vote for the conservative Republican incumbent is defined as:

\[
I_R(x_{t-1}, a) = \left\{ \theta \bigg| V^{I,R}(\theta, x_{t-1}, a) \geq V^D(\theta) \right\}
\] (20)

If preferences satisfy a single-crossing property, this is a connected set.

Figure 3 illustrates the basic mechanism. We plot the value functions associated with a Democratic challenger and two different Republican incumbents. The set \(I_R(x_{t-1}, a)\) is implicitly characterized by the intersection of the incumbent’s and challenger’s value functions. The observed vote share, denoted by \(v_t\), then satisfies:

\[
F_\theta(\theta_R(x_{t-1}, a)) = v_t
\] (21)

Given that we have identified the parameters of politicians’ preferences and the distribution of politician types in the first two stages, \(\theta_R(x_{t-1}, a)\) is known. We thus conclude that the distribution of voter’s ideal points is point identified at all values that correspond to observed

\[\text{We numerically check this condition during each step of the estimation algorithm and find that it typically holds for our specifications.}\]
vote shares of incumbents. Values of the distribution for points that are not associated with an incumbent’s vote share can only be bounded or interpolated using semi-nonparametric approximations as discussed in detail below.

In practice, we do not observe the ideological platform, \(x_{t-1}\), and the competence, \(a\). Instead we observe a vector of noisy measures, \(p_{t-1}\) that are correlated with both variables. The expected vote share of the incumbent conditional on observing \(p_{t-1}\) is, therefore, given by:

\[
E[v_t|p_{t-1}] = \int \int F_\theta(\theta_R(x_{t-1}, a)) \, g_R(x_{t-1}, a|p_{t-1}) \, dx_{t-1} \, da
\]

where the conditional density \(g_R(x_{t-1}, a|p_{t-1})\) can be derived from the measurement model in equation (15) and is thus non-parametrically identified. We can use a flexible parametrization for \(F_\theta(\cdot)\) and estimate its parameters by minimizing the squared differences between the observed and the predicted vote shares in equation (22). Moreover, we can use any policy \(p\) to implement this procedure, which then gives rise to many potential moment conditions.
3.4 Semi-parametric Estimation

The proofs of identification are constructive and can be used to define a sequential moments estimator. The estimator has three steps:

1. We use co-variance restrictions to estimate the factor loading coefficients. We then use Kotlarski’s Theorem to estimate the distribution of ideology. To ease the burden of computing equilibria, we approximate the density of ideology and ability obtained from Kotlarski’s Theorem using standard semi-nonparametric methods.

2. We use moment restrictions based on the fraction of extremists that are not reelected in the first period conditional on the observed vector of observed policies and party membership. We also construct moment conditions based on the observed mean and variance of policies of candidates that win reelection. Term limits give rise to policy moderation in the first period relative to the second period. The degree of observed policy moderation depends on the functions and parameters of our model. We solve the model and simulate policy outcomes. We match the moments of the distribution of observed policies for each party for two-term politicians.\textsuperscript{22}

3. We construct moment conditions by matching the predicted vote shares with the observed vote shares of reelected incumbents conditional on observed policies.

We use bootstrap methods to estimate standard errors for the parameters and functions of interest and to account for the sequential nature of our estimators.

\textsuperscript{22}We also construct moment conditions based on the modified Besley & Case regressions discussed in Appendix D.1.
4 Data

Our data set is based on all gubernatorial elections between 1950 and 2012 in the U.S. In constructing our data, we closely follow Besley and Case (1995) (BC) to guarantee that our findings are comparable to their study. We have also replicated and extended their findings using our sample.\textsuperscript{23} The Book of the States provides detail information about gubernatorial term limits. Appendix A summarizes term limits by state during our sample period. Our main sample is based on the 23 states that have adopted a limit of two consecutive terms.\textsuperscript{24}

Data on vote shares, party affiliation, and incumbency status of candidates in gubernatorial elections are based on a web site called www.ourcampaigns.com. Table 1 summarizes the election data.

Table 1: Winners’ Vote Shares, Party Affiliation, and Incumbency Status

<table>
<thead>
<tr>
<th>Variable</th>
<th>Obs</th>
<th>Winner’s Vote Share</th>
<th>Democratic Party</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>263</td>
<td>0.58</td>
<td>0.50</td>
</tr>
<tr>
<td>Incumbent</td>
<td>103</td>
<td>0.61</td>
<td>0.50</td>
</tr>
<tr>
<td>Challenger against Incumbent</td>
<td>37</td>
<td>0.54</td>
<td>0.54</td>
</tr>
<tr>
<td>Challenger in open election</td>
<td>123</td>
<td>0.57</td>
<td>0.49</td>
</tr>
</tbody>
</table>

Note: The vote share is calculated based on votes cast for the two candidates.

We use the same policy outcome measures as BC. Taxes can be obtained from the state government tax data collected by U.S. Census. We focus on total general sales tax, individual income tax, and corporate net income tax, which account for the vast majority of state tax receipts. Total general expenditures are also obtained from the U.S. Census. The Monthly

\textsuperscript{23}Since our findings are almost identical to the previous set papers, we do not report them in this paper.

This analysis is available upon request from the authors.

\textsuperscript{24}Note that different states have adopted term limits at different points of time. In addition to the 23 states that constitute our main sample, there are two states limiting governors to serve 8 years out of 12 years in office.
Labor Review and the Report on the Minimum Wage Commission provide detailed data on minimum wages for each state in the U.S. Finally, data on worker's compensations can be obtained from the Analysis of Worker's Compensation Law and the Book of States. Workers compensation is measured as the maximum weekly benefits for temporary total disability. Temporary total disability benefits are paid during the period an employee is unable to work due to the effects of the work-related injury, subject to the waiting period, if applicable.

In addition, we collect a variety of other outcomes that are more closely related to the managerial competence of a governor. Following Alt, Bueno de Mesquita, and Rose (2011), we focus on economic growth and borrowing cost. State total income is from Bureau of Economic Analysis (BEA). Total interest expenditure on debt and total debt are from U.S. Government Census (the same as tax and expenditure).

Table 2: State Policy and Economic Variables, 1950-2012

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales tax</td>
<td>367</td>
<td>171</td>
</tr>
<tr>
<td>Income tax</td>
<td>189</td>
<td>186</td>
</tr>
<tr>
<td>Corporate tax</td>
<td>44</td>
<td>36</td>
</tr>
<tr>
<td>State spending</td>
<td>1326</td>
<td>704</td>
</tr>
<tr>
<td>Minimum wage</td>
<td>2.1</td>
<td>1.4</td>
</tr>
<tr>
<td>Maximum weekly benefits</td>
<td>239</td>
<td>108</td>
</tr>
<tr>
<td>Economic growth rate (%)</td>
<td>7.1</td>
<td>4.2</td>
</tr>
<tr>
<td>Borrowing costs (%)</td>
<td>4.5</td>
<td>2.7</td>
</tr>
</tbody>
</table>

Table 2 provides some descriptive statistics of our policy outcome measures. All taxes, income, and expenditure are per capita in 1982 dollars. To account for heterogeneity among states as well as business cycle and growth effects, we regress all policy outcomes on a full set of state and time dummy variables as well as state income, state population, fraction of old,
and fraction of young. We then use the time and state adjusted policies when we implement the estimator of our model. This approach is similar to the one taken by Besley and Case (1995).\(^{25}\)

5 Empirical Results

We implement our semi-parametric estimator using the six policy outcome measures discussed above. Table 3 reports the parameter estimates and estimated standard errors. Standard errors are computed using a bootstrap algorithm.

Recall that we normalize the ideology coefficient of expenditures and the coefficient of competence in the income growth equation to be equal to one. Given these normalizations, the signs of all estimated coefficients are correct. Ideology has a large impact on the first three outcomes: expenditures, taxes, and minimum wages. Fiscal conservatives prefer lower expenditures, lower taxes, and lower minimum wages than fiscal liberals. Competence primarily drives the last three outcomes: income growth, workers compensation, and cost of borrowing. Higher competence leads to higher economic growth, higher workers compensation, and lower costs of financing debt. Ideology has a much smaller, but not negligible impact on these three outcomes. We view these results as providing strong positive evidence for our exclusion restrictions.

There are also some differences in how strongly Republicans and Democrats value holding office with Republicans having stronger preferences for being in office. Our findings suggest that the benefits from holding office are significant and large in economic magnitude. As a consequence, the prospects of reelection provide strong incentives for moderate governors.

\(^{25}\)Alternatively, we would adopt a parametric approach and allow the parameters of the underlying preferences and distribution of ideology and ability to depend on observed state characteristics. Below, we also conduct a split sample test to evaluate the assumption that the underlying joint distribution of ideology and ability is time invariant.
### Table 3: Estimates and Standard Errors

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimate</th>
<th>S.E.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Factor Loadings: Ideology</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expenditures</td>
<td>$\mu_{11}$</td>
<td>1</td>
</tr>
<tr>
<td>Taxes</td>
<td>$\mu_{21}$</td>
<td>0.7732 0.0520</td>
</tr>
<tr>
<td>Minimum wages</td>
<td>$\mu_{31}$</td>
<td>0.9293 0.0359</td>
</tr>
<tr>
<td>Economic growth</td>
<td>$\mu_{41}$</td>
<td>-0.1123 0.0133</td>
</tr>
<tr>
<td>Workers comp</td>
<td>$\mu_{51}$</td>
<td>0.2977 0.0838</td>
</tr>
<tr>
<td>Debt costs</td>
<td>$\mu_{61}$</td>
<td>0.0545 0.0099</td>
</tr>
<tr>
<td><strong>Factor Loadings: Competence</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Economic growth</td>
<td>$\mu_{42}$</td>
<td>1</td>
</tr>
<tr>
<td>Workers comp</td>
<td>$\mu_{52}$</td>
<td>1.2147 0.2777</td>
</tr>
<tr>
<td>Debt costs</td>
<td>$\mu_{62}$</td>
<td>-0.6933 0.1835</td>
</tr>
<tr>
<td><strong>Utility Function</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benefits of holding office</td>
<td>$\psi_D$</td>
<td>0.6184 0.0664</td>
</tr>
<tr>
<td>Benefits associated with Competence</td>
<td>$\lambda$</td>
<td>0.1144 0.0289</td>
</tr>
<tr>
<td>Cost of Incumbent Governor</td>
<td>$\gamma_D$</td>
<td>0.2418 0.0392</td>
</tr>
<tr>
<td>Shock in open election</td>
<td>$\sigma$</td>
<td>0.5879 0.2048</td>
</tr>
</tbody>
</table>
to move towards the center of the ideological spectrum during their first term in office. Based on the model estimates we can then predict the fraction of moderate and centrist politicians for each party. We find that 43.8 (34.6) percent of all Republicans (Democrats) are moderates while 24.9 (26.6) percent are centrists. These estimates suggest that a large fraction of candidates engage in policy moderation during the first term. The differences in the estimates of $\psi$ are primarily driven by observed differences in the magnitude of policy moderation.

Voters of all ideological types strongly value competence as indicated by the economically large value of $\lambda$. A one standard deviation increase in ability is thus equivalent to an ideological moderation by 0.11 of a standard deviation in ideology. Ideology is, therefore, more important in explaining voter behavior than competence. Nevertheless, there exists a significant trade-off between ideology and competence.

Moreover, the costs of reelecting incumbent is quite significant and large. For Democrats (Republicans) these costs are 0.24 (0.18). The differences in costs are largely driven by the observed differences in reelection probabilities.26

We find that there are large differences in ideology across states which are captured in our modeling approach by differences in the median of the ideological distributions. On average, politicians from Nebraska are much more in favor of small government than politicians from Pennsylvania. In addition, there are clearly significant differences in the ideological positions of candidates by party. Figure 4 plots the estimates of the distribution of ideological positions and competence by party. The differences in the two distributions are large and statistically significant. As expected, the mean of the Democratic distribution is significantly larger than the mean of the Republican distribution, implying that, on average, Democrats prefer higher

\footnote{Our estimates for the probability that a Democrat will win an open election, denoted by $P_D$, is 0.49 which indicates that open election are very competitive. The implies an estimates of $\sigma$ of 0.588, which shows that our mode predicts the outcome of open elections well. We do not need an election shock with a large variance.}
Figure 4: The Distribution of Ideological Positions and Competence by Party
taxes and expenditures than Republications. However, there is also much overlap in the relevant support of both distributions. Candidates with negative values can be viewed as “fiscal conservatives,” while candidates with positive values are ” fiscal liberals.”

We have also investigated whether politicians have become more polarized in the U.S. since the 1980’s. To test the polarization hypothesis we split the sample into two subsample (pre- and post 1980). We estimate the model separately for each subsample. Surprisingly, we find that there is not much evidence which would suggest that ideological positions have diverged at the gubernatorial level. For example, there are no clear patterns in tax or expenditure data that would suggest that low tax and expenditure states have become more conservative or that high tax and expenditure states have become more liberal. Moreover, we find little evidence that would suggest an increasing gap in the ideological distributions over time.27 This finding is in contrast to recent research that primarily focuses on polarization at the federal level of government. Also note that the evidence at the federal level is largely based on voting behavior in Congress, and not on differences in tax and expenditure policies.28

In addition, Figure 4 shows there is much heterogeneity in competence. However, we do not find any significant differences among parties. No party has a clear advantage in competence.

Table 4 reports the moments that are matched in estimation. Overall, we find that our model fits the data well, including the moments that measure the reelection probabilities conditional on ability and the moments that measure the policy moderation. However, there are some dimensions of the data that are harder to match. For example, the observed standard deviation of second term tax policies is only slightly larger than the standard deviation of first term tax policies. Our model predicts larger differences. Moreover, the standard deviation of policies adopted by extremists is lower than then one predicted by the model. As we discuss

27 A detailed analysis is available upon request from the authors.
28 See, for example, McCarty, Poole, and Rosenthal (2006) for discussion of the literature and some evidence based on dw-nominate scores.
below, lack of ability seems to be a major factor in explaining why governors are not reelected

<table>
<thead>
<tr>
<th>Table 4: Goodness of Fit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moment</td>
</tr>
<tr>
<td>Probability of D</td>
</tr>
<tr>
<td>loosing reelection R</td>
</tr>
<tr>
<td>Probability of $p_4 &lt; -\sigma_4$</td>
</tr>
<tr>
<td>loosing reelection $-\sigma_4 &lt; p_4 &lt; 0$</td>
</tr>
<tr>
<td>By income growth $0 &lt; p_4 &lt; \sigma_4$</td>
</tr>
<tr>
<td>$(p_4)$ $p_4 &gt; \sigma_4$</td>
</tr>
<tr>
<td>Variance of D 1st term</td>
</tr>
<tr>
<td>Expenditure D 2nd term</td>
</tr>
<tr>
<td>R 1st term</td>
</tr>
<tr>
<td>R 2nd term</td>
</tr>
<tr>
<td>Modified B&amp;C Liberal D 1st term</td>
</tr>
<tr>
<td>Regression Coefficient Conservative D 1st term</td>
</tr>
<tr>
<td>of 1st Term Dummy Liberal R 1st term</td>
</tr>
<tr>
<td>(Expenditure) Conservative R 1st term</td>
</tr>
<tr>
<td>Average Vote Shares D</td>
</tr>
<tr>
<td>of 2 Term Governors R</td>
</tr>
</tbody>
</table>

Figure 5 plots the estimated densities of ideological positions of voters and candidates. Figure 5 shows that political candidates tend to be less radical than voters. This finding is plausible since the distribution of politicians is restricted to potential candidates. These candidates must be viable and are thus screened carefully by parties. Moreover, they typically have to survive an internal primary process to win the party nomination. This process may help to eliminate candidates that are considered to be too extreme in their ideologies.

Finally, we have estimated two other model specifications as robustness checks. First, we
consider a model in which the governor’s utility function does not depend on his or ability. If we ignore this term, the election standard and the cutoffs are parallel. By adding the ability term to the governor’s utility function, the ideological thresholds have a steeper slope than the election standards. We find that our main qualitative and quantitative findings are not affected by this change. The main difference is that we obtain a slightly smaller estimate of $\lambda$ and a larger estimate of the standard deviation of the election shock, denoted by $\sigma$.

Second, we estimated a specification in which the pay-off politicians when not in office should be equal to the citizen’s pay-off not zero. The key equilibrium condition that defines the reelection thresholds is now given by:

$$-|\bar{\rho}_R(a) - \bar{s}_R(a)| + \gamma (\lambda a + \psi) + \gamma^2 V^\sigma(\bar{\rho}_R(a)) - \gamma V^D(\bar{\rho}_R(a)) = 0$$

(23)

Notice that the only difference between this specification and our baseline model is that the pay-offs of staying in office now include a third term given by $\gamma^2 V^\sigma(\bar{\rho}_R(a)) - \gamma V^D(\bar{\rho}_R(a))$. 
Estimating the model we find that this term is not large. We find leads to a lower estimate of $\lambda$. Otherwise the estimates are similar to the ones of our baseline model. Overall, we conclude that our estimates are robust to these changes in the specification of the model.

6 Welfare Analysis of Term Limits

We study the impact of of term limits on electoral outcomes, economic policies, and voters’ welfare. The natural benchmark is a model without term limits. We, therefore, solve our model with and without term limits and compare the equilibrium outcomes. First, we assume that costs of reelecting incumbents are the same in the model without term limits. While the estimated costs of reelecting incumbents are statistically and economically significant, they are not sufficiently high to imply that term limits are welfare improving. This comparison is likely to provide a lower bound of the welfare gains associated with term limits. Implementing this approach, we find that term limits reduce welfare by approximately 8 percent.

We conduct two additional experiments. Note that incumbents have even stronger incentives without term limits to build longterm relationships with insiders and lobbyists. It is thus plausible that the costs of reelecting incumbents are much higher without term limits. In our next experiment we evaluate the model with term limits at our estimates. For the case without term limits we compute welfare as a function of the reelection costs. Our main result is illustrated in Figure 6. We find that increasing the costs by 80 percent is sufficient for term limits to be welfare improving.

In our last experiment we increase the costs of reelecting incumbents in both models, but assume costs are symmetric. By reelecting an incumbent whose platform is between the two election standards, voters can retain centrist politicians and induce policy moderation. With a two-term limit, voter do not need to commit more than one additional term. In a model without term limits it is more costly to commit to a politician. Voters pay the cost
permanently once they commit to the incumbent. As a consequence we do not need to rely on differences in costs across institutions to justify term limits. If the reelection costs are sufficiently large, term limits are desirable. Figure 6 suggests that term limits are also welfare improving if costs are approximately 2.5 times our estimates.

The policy experiments show that term limits potentially increase welfare since incumbents have fewer incentives to invest into longterm relationships with political insiders and lobbyists, and as a consequence potentially lower the costs of reelecting an incumbent for a second term. Moreover, this commitment is only for one more term, while the commitment is potentially much longer if term limits do not exist. These two effects improve voters’ welfare. Term limits reduce welfare for two reasons. First, term-limited governors have no incentives to moderate in their last term policies. Second, some qualified politicians such as centrist or high ability governors are removed from office despite the fact that voter would prefer to reelect them. It is useful to take a closer look at those two channels through which term limits have a negative impact on voter’s welfare.
Table 5: Competence and Policies

<table>
<thead>
<tr>
<th></th>
<th>2 Term Limit</th>
<th>No Term Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competence</td>
<td>-0.0176</td>
<td>0.0128</td>
</tr>
<tr>
<td>Policy: Mean</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expenditure</td>
<td>-15.1726</td>
<td>-6.1323</td>
</tr>
<tr>
<td>Tax</td>
<td>-6.7165</td>
<td>-2.8588</td>
</tr>
<tr>
<td>Minimum Wage</td>
<td>-0.0613</td>
<td>-0.0246</td>
</tr>
<tr>
<td>Income Growth</td>
<td>0.0040</td>
<td>0.0526</td>
</tr>
<tr>
<td>Compensation</td>
<td>-1.7493</td>
<td>-0.0958</td>
</tr>
<tr>
<td>Borrowing Cost</td>
<td>0.0049</td>
<td>-0.0105</td>
</tr>
<tr>
<td>Policy: Standard Deviation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expenditure</td>
<td>185.7172</td>
<td>133.5271</td>
</tr>
<tr>
<td>Tax</td>
<td>87.7020</td>
<td>69.6585</td>
</tr>
<tr>
<td>Minimum Wage</td>
<td>0.7878</td>
<td>0.5925</td>
</tr>
<tr>
<td>Income Growth</td>
<td>2.6834</td>
<td>2.6668</td>
</tr>
<tr>
<td>Compensation</td>
<td>41.0715</td>
<td>40.0095</td>
</tr>
<tr>
<td>Borrowing Cost</td>
<td>0.9363</td>
<td>0.9348</td>
</tr>
</tbody>
</table>
Table 5 reports mean and variance of policy outcomes as well as mean competence under both regimes. We find that the differences in mean policies are small among the two institutional designs. Differences primarily arise because the average level of competence of governors is higher in a model without term limit. Term limits also have a much larger impact on the variance of policies that are primarily driven by ideology. The standard deviations of policies driven by ideology are significantly smaller compared to those in a model without term limits. Policies that are largely a function of ability are not strongly affected by term limits. This increase in the variance of policies then implies that term limits decrease welfare since voters are risk-averse.

7 Conclusions

We have considered an important class of dynamic games of electoral competition that play a large role in the theoretical literature in political economy. Candidates are drawn from different distributions of ideological positions and competence, which captures one of the key trade-offs faced by voters. We have shown that a class of dynamic games with perfect monitoring is identified and can be estimated using standard semi-parametric techniques. Our findings suggest that voters are willing to accept significant trade-offs in ideology to obtain a more competent governor. There are significant benefits associated with holding office. As a consequence, the prospects of reelection provide strong incentives for moderate governors to move towards the center of the ideological spectrum during the first term in office. Finally, the costs of reelecting incumbents are large and significant. As a consequence, term limits may be welfare improving.

Our welfare analysis provides a careful analysis of the pros and cons associated with term limits. On the one hand, term limits imply more volatility in policies. Some capable politicians are removed from office because of term limits that would have won easy reelection. These two effects lower voters' welfare. On the other side, term limits provide fewer incentives
for incumbents to invest into longterm relationships with political insiders and lobbyists, and as a consequence potentially lower the costs of reelecting an incumbent for a second term. This effect improves voters’ welfare. A careful analysis of term limits needs to take these opposing effects into consideration. Our welfare analysis is consistent with the broader assessment that term limits may be desirable if incumbents can easily build large campaign war chests, invest in longterm relationships with special interest groups, and are therefore disconnected from the voters.

There are some potentially fruitful extensions of our approach to estimation and identification. First, we restrict attention to a class of dynamic electoral games with perfect monitoring. The key assumption here is that voters perfectly observe the chosen ideological position and the level of competence for each politician in office. An alternative approach would be to assume that the adopted platform and ability are observed with noise by both the voters in the model and the econometrician. While this assumption may be more elegant, it is well-known that it is difficult to characterize the equilibrium in these dynamic games as explained, for example, by Duggan and Martinelli (2014). Moreover, the potential selection problems encountered in the empirical analysis are rather daunting. While we believe that some of the ideas developed in this paper can be used to estimate these model as well, there still remains a lot of work that needs to be done to work out the detail. We view this as a great potential for future research.

Our model also abstracts from the fact that voters and politicians may care about a higher dimensional space of policies. In our model voters and politicians only care about ability and endogenous ideological position. There is a long tradition of models in political economy that make similar assumptions to reduce the complexity of the analysis. One notable exception is the paper by Banks and Duggan (2008), who consider a dynamic game of electoral competition in which voters and politicians have preferences defines over a vector of policies. We have

\[ \text{One well-known example is the seminal work by Poole and Rosenthal (1985) who estimate low dimensional spatial voting models to explain roll calls in the U.S. Congress.} \]
shown in this paper that there is value of estimating our simpler model. However, future research should determine whether new insights can be gained from estimating model with higher dimensional policy spaces.

Our modeling approach also ignores bargaining between elected governors and legislatures as well as the potential importance of party reputation. These problems pose some significant theoretical challenges, which to our knowledge have not been resolved in the theoretical literature. More research is clearly needed to clarify these issues, but we think that this paper provides some key ingredients that can also be used to estimate these models. Nevertheless, we view the methods developed in this paper for estimating dynamic games of electoral competition as promising for future research.
References


## A States with Term Limits

Table 6: Term Limitations by State in 2013

<table>
<thead>
<tr>
<th>State law</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>States with no term limits</td>
<td>CT, IA, ID, IL, MA, MN, ND, NH, NY, TX, UT, VT, WA, WI</td>
</tr>
<tr>
<td>States limiting governors to 1 term in office</td>
<td>VA</td>
</tr>
<tr>
<td>States limiting governors to 8 out of 12 years in office</td>
<td>IN(1972), OR(1987)</td>
</tr>
<tr>
<td>States limiting governors to 8 out of 16 years in office</td>
<td>MT(1993), WY(1993)</td>
</tr>
</tbody>
</table>

The source is the book of the states. Note that parenthesis shows the year of change if it was after 1950. We have considered 48 constitutional states. a) NC adopted 2 lifetime term limit from 1977 to 1992. b) NM adopted 2 consecutive term limit prior to 1971 and adopted 1 term limit from 1971 to 1990. c) OR adopts 2 consecutive term limit before 1987. OK adopts 2 consecutive term limit from 1966 to 2009.
B Equilibrium Beliefs

This equilibrium can be supported by the following voting beliefs.

- If $x_t < \underline{\rho}_R(a)$, then $P_R(\rho|x_t, a) = 0$ for all $\rho < x_t$ and $P_R(\rho|x_t, a) = 1$ for all $\rho \geq x_t$. (Left Extremists)

- If $x_t = \underline{s}_R(a)$ then $P_R(\rho|x_t, a) = F_{\rho}^R(\rho|\rho \in [\underline{\rho}_R(a), \underline{s}_R(a)])$. (Left-leaning Moderates)

- If $x_t \in (\underline{s}_R(a), \bar{s}_R(a))$, then $P_R(\rho|x_t, a) = 0$ for all $\rho < x_t$ and $P_R(\rho|x_t, a) = 1$ for all $\rho \geq x_t$. (Centrists)

- If $x_t = \bar{s}_R(a)$ then $P_R(\rho|x_t, a) = F_{\rho}^R(\rho|\rho \in [\bar{s}_R(a), \bar{\rho}_R(a)])$. (Right-leaning Moderates)

- If $x_t > \bar{\rho}_R(a)$, then $P_R(\rho|x_t, a) = 0$ for all $\rho < x_t$ and $P_R(\rho|x_t, a) = 1$ for all $\rho \geq x_t$. (Right Extremists)

- If $x_t \in (\underline{\rho}_R(a), \underline{s}_R(a))$, then $P_R(\rho|x_t, a) = 0$ for all $\rho < \underline{\rho}_R(a)$ and $P_R(\rho|x_t, a) = 1$ for all $\rho \geq \underline{\rho}_R(a)$. (Beliefs when off-equilibrium deviations occur left center.)

- If $x_t \in (\bar{s}_R(a), \bar{\rho}_R(a))$, then $P_R(\rho|x_t, a) = 0$ for all $\rho < \bar{\rho}_R(a)$ and $P_R(\rho|x_t, a) = 1$ for all $\rho \geq \bar{\rho}_R(a)$. (Beliefs when off-equilibrium deviations occur right center.)
C Proof of Proposition 1

In the sub-population described in Proposition 1 we have \( x = \rho \). Substituting this equation into the measurement system, we obtain:

\[
\begin{align*}
    p_1 &= \rho + \epsilon_1 \\
    p_2 &= \mu_{21} \rho + \epsilon_2 \\
    p_3 &= \mu_{31} \rho + a + \epsilon_3 \\
    p_4 &= \mu_{41} \rho + \mu_{42} a + \epsilon_4 \\
    p_5 &= \mu_{51} \rho + \mu_{52} a + \epsilon_5
\end{align*}
\]  \hspace{1cm} (24)

We assume that \( \rho, a, \) and \( \epsilon_j \)'s are mutually independent, the means of \( \rho \) and \( a \) are finite, and \( E(\epsilon_j) = 0 \) for all \( j \). We further assume that \( \rho, a, \) and \( \epsilon_j \)'s satisfy the conditions of Fubini's theorem and have non-vanishing (a.e.) characteristic functions.

CHH (2003) show identification of the factor loadings. Here we just briefly summarize their argument. Let \( j = 1, 2 \) and \( l = 1, 2, 3, 4, 5 \) \( (j \neq l) \), we then have:

\[
cov(p_j, p_l) = \mu_{j1} \mu_{l1} \sigma_{\rho}^2
\]  \hspace{1cm} (25)

In particular

\[
\begin{align*}
    cov(p_1, p_l) &= \mu_{l1} \sigma_{\rho}^2 \\
    cov(p_2, p_l) &= \mu_{l1} \mu_{21} \sigma_{\rho}^2
\end{align*}
\]  \hspace{1cm} (26)

Hence we have:

\[
\mu_{21} = \frac{cov(p_2, p_3)}{cov(p_1, p_3)} = \frac{cov(p_2, p_4)}{cov(p_1, p_4)}
\]  \hspace{1cm} (27)

and \( cov(p_1, p_2) = \mu_{21} \sigma_{\rho}^2 \) identifies \( \sigma_{\rho}^2 \), \( cov(p_1, p_3) = \mu_{31} \sigma_{\rho}^2 \) identifies \( \mu_{31} \), \( cov(p_1, p_4) = \mu_{41} \sigma_{\rho}^2 \) identifies \( \mu_{41} \), \( cov(p_1, p_5) = \mu_{51} \sigma_{\rho}^2 \) identifies \( \mu_{51} \).
Proceeding to the next equations and note that for \( j = 3, 4 \) and \( l = 3, 4, 5 \) \((j \neq l)\) we have:

\[
\text{cov}(p_j, p_l) = \mu_{j1} \mu_{l1} \sigma_\rho^2 + \mu_{j2} \mu_{l2} \sigma_a^2
\]  

(28)

In particular:

\[
\text{cov}(p_3, p_5) - \mu_{31} \mu_{51} \sigma_\rho^2 = \mu_{52} \sigma_a^2
\]  

(29)

\[
\text{cov}(p_4, p_5) - \mu_{41} \mu_{51} \sigma_\rho^2 = \mu_{42} \mu_{52} \sigma_a^2
\]

Hence we have:

\[
\mu_{42} = \frac{\text{cov}(p_4, p_5) - \mu_{41} \mu_{51} \sigma_\rho^2}{\text{cov}(p_3, p_5) - \mu_{31} \mu_{51} \sigma_\rho^2}
\]  

(30)

and \( \text{cov}(p_3, p_4) - \mu_{31} \mu_{41} \sigma_\rho^2 = \mu_{42} \sigma_a^2 \) identifies \( \sigma_a^2 \). \( \text{cov}(p_3, p_5) - \mu_{31} \mu_{51} \sigma_\rho^2 = \mu_{52} \sigma_a^2 \) identifies \( \mu_{52} \).

CHS (2010) show non-parametric identification of the underlying density functions. Again, we briefly summarize their argument. Define:

\[
\bar{p}_1 = p_1 = \rho + \epsilon_1 = \rho + \bar{\epsilon}_1
\]  

(31)

\[
\bar{p}_2 = \frac{p_2}{\mu_{21}} = \rho + \frac{\epsilon_2}{\mu_{21}} = \rho + \bar{\epsilon}_2
\]  

(32)

Kotlarski’s Theorem then implies that the characteristic functions of \( \rho \) and \( \bar{\epsilon}_i \) are given by:

\[
\varphi_\rho(t) = \exp \left( \int_0^t \varphi_n^1(0, u) \frac{du}{\varphi_n(0, u)} \right)
\]  

(33)

\[
\varphi_{\bar{\epsilon}_1}(t) = \frac{\varphi_n(t, 0)}{\varphi_\rho(t)}
\]  

(34)

\[
\varphi_{\bar{\epsilon}_2}(t) = \frac{\varphi_n(0, t)}{\varphi_\rho(t)}
\]  

(35)

where \( \varphi_n \) is the joint characteristic function of \( \bar{p}_j \) and \( \bar{p}_j^2 \) for the restricted sample, and \( \varphi_n^1(0, u) \) denotes the derivative of this function with respect to its first argument. We can then use the
standard inversion formula to estimate the densities based on the characteristic functions:

\[ f_\rho(x) = \frac{1}{2\pi} \int_{-T}^{T} \exp(-itx)\phi_\rho(t)dt \]  
(36)

\[ f_{\epsilon_i}(x) = \frac{1}{2\pi} \int_{-T}^{T} \exp(-itx)\phi_{\epsilon_i}(t)dt \quad i = 1, 2 \]  
(37)

where \( T \) is a smoothing parameter. Next define:

\[ \tilde{p}_3 = p_3 - \mu_{31}p_1 = a + \epsilon_3 + \mu_{31}\epsilon_1 = a + \tilde{\epsilon}_3 \]  
(38)

\[ \tilde{p}_4 = \frac{1}{\mu_{42}}p_4 - \frac{\mu_{41}}{\mu_{42}\mu_{21}}p_2 = a + \frac{1}{\mu_{42}}\epsilon_4 + \frac{\mu_{41}}{\mu_{42}\mu_{21}}\epsilon_2 = a + \tilde{\epsilon}_4 \]  
(39)

Applying Kotlarski’s Theorem on the two transformed measurements above yields the distribution of \( a \).

### D Additional Empirical Evidence

#### D.1 Evidence Supporting Policy Moderation

The key prediction of our dynamic game is that a subset of two-term governors will engage in policy moderation to win reelection. We have denoted these types as Moderates to distinguish them from Centrists, who are very close to the ideal point of the median voter and do not need to moderate. In this section we present evidence that supports this key prediction and shows that the data are broadly consistent with our model.

One way to measure policy moderation is to analyze the differences in the standard deviation of policies adopted in the first and second term restricting attention to a subsample of two-term governors. Broadly speaking, our model implies that the observed standard deviation of policies of successful incumbents should be larger in the second term than in the first term.

Table 7 reports the empirical results for the three outcomes studied that are primarily driven by ideology. We find that the standard deviation of first term policies is smaller
than the standard deviation of second term policies for all three outcome measures that are strongly correlated with ideology. Using conventional levels of significance, the difference is significantly different from zero in two out of three cases. We have also conducted the same analysis for each party. Our qualitative findings are similar once we condition on party membership. The main difference is that we find more pronounced differences in the standard deviations for Republicans than Democrats, especially for tax and minimum wage policies.

Second, our model also suggests that the effect of policy moderation depends on which side of the median voter a governor is located. All moderates need to move towards the center to win reelection. A fiscally conservative moderate must adopt higher taxes and expenditures in the first term than in the second term to win reelection. A fiscally liberal moderate must adopt lower taxes and expenditures in the first term than in the second term. Note that this prediction holds for both parties. The degree of policy moderation is, however, party specific.

This insight then suggests a modified version of the Besley & Case regression. Again, we restrict the sample to successful two-term governors. We split the sample not only based on party affiliation, but also based on an indicator of ideology, which uses the second period tax or expenditure policies to classify governors as liberal or conservative. Table 8 reports the results of these modified Besley & Case regression exercises. We find that these results are very supportive of our modeling strategy. Conservatives adopt higher tax and spending policies in the first period while liberals do exactly the opposite regardless of their party affiliation. Our

<table>
<thead>
<tr>
<th></th>
<th>std deviation</th>
<th>std deviation</th>
<th>One sided Test</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1st term</td>
<td>2nd term</td>
<td></td>
<td></td>
</tr>
<tr>
<td>expenditures</td>
<td>94.88</td>
<td>118.96</td>
<td></td>
<td>0.0000</td>
</tr>
<tr>
<td>taxes</td>
<td>56.47</td>
<td>58.52</td>
<td></td>
<td>0.2530</td>
</tr>
<tr>
<td>minimum wage</td>
<td>0.46</td>
<td>0.51</td>
<td></td>
<td>0.0203</td>
</tr>
</tbody>
</table>
findings thus suggests that the ideology of the candidate may be more important than party membership in explaining outcomes. We, therefore, conclude that this evidence provides strong support for one of the key predictions of our model.

### D.2 Evidence Supporting Extremism of One-Term Governors

In this section we provide additional evidence that supports the prediction of our model that there exists a class of extremists that do not engage in policy moderation during the first term. Table 9 compares one-term governors (extremists) with two-term governors (non-extremists). First, consider the policies that are largely a function of ideology: expenditures, taxes or minimum wages. Not surprisingly, we do not find large difference in the mean policies since extremists from both sides of the political spectrum tend to cancel each other out. More relevant is the fact that the standard deviation of tax and expenditure policies is significantly larger for one-term governors than the standard deviation of first term policies of two-term governors. This indicates that one term governors tend to favor more extreme policies just
as our model predicts.

Table 9: Comparison Between One- and Two-Term Governors

<table>
<thead>
<tr>
<th></th>
<th>expenditure</th>
<th>tax</th>
<th>minimum wage</th>
<th>income growth</th>
<th>workers comp</th>
<th>borrowing cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two-term governor</td>
<td>4.0457</td>
<td>2.3517</td>
<td>0.0435</td>
<td>0.1291</td>
<td>0.9428</td>
<td>-0.0120</td>
</tr>
<tr>
<td>One-term governor</td>
<td>-3.2749</td>
<td>-0.7250</td>
<td>-0.0015</td>
<td>-0.2971</td>
<td>-1.6253</td>
<td>0.1436</td>
</tr>
<tr>
<td>Dif in Means Test</td>
<td>0.4154</td>
<td>0.5721</td>
<td>0.2833</td>
<td>0.0302</td>
<td>0.2401</td>
<td>0.0318</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>expenditure</th>
<th>tax</th>
<th>minimum wage</th>
<th>income growth</th>
<th>workers comp</th>
<th>borrowing cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two-term governor</td>
<td>94.8822</td>
<td>56.4671</td>
<td>0.4562</td>
<td>2.0172</td>
<td>23.7124</td>
<td>0.6704</td>
</tr>
<tr>
<td>One-term governor</td>
<td>107.1175</td>
<td>66.5697</td>
<td>0.4756</td>
<td>2.4270</td>
<td>24.9530</td>
<td>0.9963</td>
</tr>
<tr>
<td>Dif in Variance Test</td>
<td>0.0271</td>
<td>0.0044</td>
<td>0.2534</td>
<td>0.0016</td>
<td>0.2084</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

We report p-values for the difference in means and variances test.

Next consider the policies that are primarily a function of ability: income growth, workers compensation, and borrowing costs. Table 9 shows that one-term governors have lower GDP growth rates, lower worker’s compensation, and higher borrowing costs than two-term governors. These measures are highly correlated with ability according to our estimates. We, therefore, find some strong evidence that failure of reelection is not just due to ideological extremism, but also due to lack of ability or valence.

We thus conclude that there is strong evidence that one-term governors are more extreme on the ideological scale and less competent than two-term governors. These findings are broadly consistent with the predictions of our model.
D.3 One-Term Governors by Type

In this section we consider the subsample that consists of one term governors that unsuccessfully ran for reelection and those who retired without seeking reelection. Table 10 summarizes the differences in mean policies among these one-term governors.

Table 10: Mean Policies of One-Term Governors by Type

<table>
<thead>
<tr>
<th></th>
<th>expenditure</th>
<th>tax</th>
<th>minimum</th>
<th>income</th>
<th>workers</th>
<th>borrowing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>lost</td>
<td>9.8426</td>
<td>-0.8354</td>
<td>-0.0377</td>
<td>-0.3248</td>
<td>6.2356</td>
<td>0.0887</td>
</tr>
<tr>
<td>retired</td>
<td>-31.9557</td>
<td>-0.4836</td>
<td>0.0778</td>
<td>-0.2366</td>
<td>-18.8126</td>
<td>0.2635</td>
</tr>
<tr>
<td>Dif in Means Test</td>
<td>0.0126</td>
<td>0.9733</td>
<td>0.1226</td>
<td>0.8179</td>
<td>0.0000</td>
<td>0.2656</td>
</tr>
</tbody>
</table>

We report p-values for the difference in means tests.

Overall, we find that the differences between the two subsamples are small. Expenditure and workers compensation are significantly lower for governors that retired and did not seek reelection. If anything, governors that retired instead of running for reelection appear to be of lower ability and potentially more extreme than those who unsuccessfully ran for the reelection.

The sample of one-term governors that did not seek reelection is too small to determine whether these governors strategically decided to not seek reelection. A case-by-case analysis suggests that one-term governors do not run for reelection for variety of reasons (such as scandals, campaigns for senate seats, health problems). We did not uncover any systematic patterns that would indicate strategic retirement.