Econometrica, Vol. 71, No. 1 (January, 2003), 27–70

A STRUCTURAL MODEL OF GOVERNMENT FORMATION

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In this paper we estimate a bargaining model of government formation in parliamentary democracies. We use the estimated structural model to conduct constitutional experiments aimed at evaluating the impact of institutional features of the political environment on the duration of the government formation process, the type of coalitions that form, and their relative stability.

KEYWORDS: Political stability, bargaining, coalitions, government formation, government dissolution, comparative constitutional design.

1. INTRODUCTION

THE DEFINING FEATURE of parliamentary democracies is the fact that the executive derives its mandate from and is politically responsible to the legislature. This implies that who forms the government is not determined by an election alone, but is the outcome of a bargaining process among the parties represented in the parliament. Furthermore, it implies that the government may terminate at any time before the expiration of a parliamentary term if it loses the confidence of the parliament.

Parliamentary democracies, however, differ with respect to the specific rules in their constitutions that prescribe how their governments form and terminate (Lijphart (1984), Muller and Strom (2000), Inter-Parliamentary Union's archives at http://www.ipu.org). These differences include whether the government needs an actual vote by parliament to legally assume office (the so-called *investiture vote*), whether the government must maintain the active support of a parliamentary majority in order to remain in office (the so-called *positive parliamentarism*), whether the rules for tabling a vote of no-confidence require an alternative to be prespecified (the so-called *constructive vote of no-confidence*), and whether elections have to be held at predetermined intervals (the so-called *fixed interelection period*).[2]

[1] We would like to thank three anonymous referees and a co-editor for their useful comments and suggestions. Mike Keane, Ken Wolpin, the participants of the "Edmond Malinvaud" seminar at CREST-INSEE, the 1999 Wallis Conference on Political Economy at the University of Rochester, the 2000 meeting of the Research Group on Political Institutions and Economic Policy at Harvard University, the 2001 CEPR Conference on The Economic Analysis of Political Institutions, and seminar participants at Caltech, Chicago, Harvard, Georgetown, Northwestern, and the University of Pennsylvania provided helpful comments. Financial support from the National Science Foundation, and the Weatherhead Center for International Affairs and the Center for Basic Research in the Social Sciences at Harvard University, is gratefully acknowledged. Carl Coscia provided excellent research assistance in the early stages of the project.

[2] Parliamentary democracies also differ in their electoral laws. In this paper, we abstract from differences in electoral institutions and restrict attention to parliamentary systems with proportional

Parliamentary democracies also differ systematically with respect to the observed duration of their government formation processes, the type (i.e., minority, minimum winning, or surplus) and size of the government coalitions that result from these processes, and the relative durability of their governments. For example, in some countries like Denmark minority governments are virtually the norm, while in Germany they are a rare occurrence. Also, surplus governments are rather frequent in Finland, while they never occur in Sweden. Similarly, governments in Italy are notoriously unstable, while Dutch governments frequently last the entire legislative period (Laver and Schofield (1990), Strom (1990)).

These observations raise the following important questions: Can constitutional features account for these observed differences? And, if so, which institutions are quantitatively most important for the type and the stability of coalition governments? Providing answers to these questions is very important for the design (or redesign) of constitutions in modern parliamentary democracies.[3] For example, the German constitutional convention created the constructive vote of no-confidence with the explicit intent of preventing unstable governments. To achieve the same goal, Belgium in 1995 amended its constitution to eliminate the investiture vote and adopt the constructive vote of no-confidence. Answering these questions has also important economic implications. For example, empirical studies have demonstrated that political instability has a detrimental effect on economic performance and growth (see, e.g., Alesina et al. (1996) and Barro (1991)). For a parliamentary democracy, political instability means short-lived governments and long-lasting negotiations.

The main goal of this paper is to address the questions we posed above and investigate the effects of specific institutional features of parliamentary democracies (i.e., the investiture vote, positive parliamentarism, the constructive vote of no-confidence, and a fixed interelection period), on the formation and dissolution of coalition governments. Hence, the paper contributes to a growing area of research in political economy, whose aim is to assess the political and economic consequences of political institutions (see, e.g., Besley and Coate (1997, 1998), Grossman and Helpman (1994), Myerson (1993), and Persson, Roland, and Tabellini (1997, 2000)).[4]

For the most part, the theoretical and the empirical literature on government formation and termination have been proceeding in parallel ways. Empirical studies are typically concerned with establishing stylized facts outside the context of any theoretical model.[5] Theoretical contributions typically aim at providing

representation. By holding the electoral system constant, we can focus on the institutional rules that govern the formation and termination of governments.

[3] Several "young" democracies, like the countries that emerged from the collapse of the East European block, are currently facing these issues. Some of the "older" democracies, for example Belgium and Italy, are also experimenting with changes in their constitution. Moreover, the European unification process may lead to the formation of a "European state" whose constitution presumably would draw from the existing constitutions of the member states.

[4] For an extensive survey of the literature, see Persson and Tabellini (2000).

[5] For recent overviews of the large empirical literature on government formation and termination, see Laver and Schofield (1990), Laver and Shepsle (1996), Strom (1990), and Warwick (1994).

tractable models that may explain some of these facts, but are in general not suitable for empirical analysis.[6]

An exception is represented by the work of Merlo (1997) who estimates a structural model of government formation in postwar Italy and uses the estimated model to evaluate the effect of bargaining deadlines on negotiation delays and government stability. Merlo's analysis, however, is tailored to a specific institution (Italy's political system after World War II) and takes the set of parties that have agreed to try forming a government together (what we refer to as the *proto-coalition*) as given.

In this paper, we use newly collected data from nine West European countries over the period 1947–1999 to estimate a structural model of government formation in parliamentary democracies. The theoretical model we consider extends the bargaining model proposed by Merlo (1997) to endogenize the formation of the proto-coalition and the selection of the proto-coalition *formateur* (i.e., the party chosen by the head of state to try to form a government). Our analysis accounts for many of the empirical regularities identified by the existing literature and interprets them in the context of an equilibrium model that fits the data well. In addition, our approach allows us to conduct constitutional experiments to evaluate the effect of institutional features of the political environment on the outcomes of the bargaining process: that is, which coalition forms the government, the number of attempts it takes to form the government, and the stability of the government.

Our main findings highlight the importance of constitutional rules for government formation and stability. For example, we find that the most stable political system (i.e., the political system with the shortest government formation duration and the longest government duration) has a positive form of parliamentarism with the constructive vote of no-confidence, no investiture vote, and a fixed interelection period. At the opposite end of the spectrum, the least stable political system (i.e., the political system with the longest government formation duration and the shortest government duration) has a positive form of parliamentarism with the investiture vote, no constructive vote of no-confidence, and no fixed interelection period. We also use our estimated model to assess the propensity of different political systems to generate government coalitions of different types and sizes, and to evaluate the effects of changes in the length of time between elections, or in the formateur selection process, on the formation and duration of governments.

The remainder of the paper is organized as follows. In Section 2 we present the model. In Section 3 we describe the data and in Section 4 the econometric specification. Section 5 contains the results of the empirical analysis. Constitutional experiments and concluding remarks are presented in Section 6.

[6] See, for example, Austen-Smith and Banks (1988, 1990), Baron (1989, 1991, 1993, 1998), Baron and Diermeier (2001), Baron and Ferejohn (1989), Diermeier and Feddersen (1998), Diermeier and Merlo (2000), Laver and Shepsle (1990, 1998), and Lupia and Strom (1995).

2. MODEL

We consider a bargaining model of government formation in parliamentary democracies that builds on our previous work (Diermeier and Merlo (2000) and Merlo (1997)). Let $N = \{1, \ldots, n\}$ denote the set of parties represented in the parliament and let $\pi \in \Pi = \{(\pi_1, \ldots, \pi_n) : \pi_i \in (0,1), \sum_{i \in N} \pi_i = 1\}$ denote the vector of the parties' relative shares in the parliament.[7]

Each party $i \in N$ has linear von Neumann-Morgenstern preferences over the benefits from holding office $x_i \in \mathbb{R}_+$ and the composition of the government coalition $G \subseteq N$,

$$U_i(x_i, G) = x_i + u_i^G, \tag{1}$$

where

$$u_i^G = \begin{cases} \varepsilon_i^G & \text{if } i \in G, \\ \eta_i^G & \text{if } i \notin G, \end{cases} \tag{2}$$

$\varepsilon_i^G > \eta_i^G$, $\varepsilon_i^G, \eta_i^G \in \mathbb{R}$. This specification captures the intuition that parties care both about the benefits from being in the government coalition (and, for example, controlling government portfolios) and the identity of their coalition partners. In particular, ε_i^G can be thought of as the utility that a party in the government coalition obtains from implementing government policies. The policies implemented by a government depend on the coalition partners' relative preferences over policy outcomes and on the institutional mechanisms through which policies are determined. In this paper, we abstract from these aspects and summarize all policy related considerations in equation (2).[8] The assumption that $\varepsilon_i^G > \eta_i^G$ for all $i \in N$ and for all $G \subseteq N$, implies that, *ceteris paribus*, parties always prefer to be included in the government coalition rather than being excluded. We let $\beta \in (0,1)$ denote the common discount factor reflecting the parties' degree of impatience.

Our analysis begins after an election or the resignation of an incumbent government (possibly because of a general election or because of a no-confidence vote in the parliament). We let $\overline{T}$ denote the *time horizon* to the next scheduled election (which represents the maximum amount of time a new government could remain in office) and $s \in S$ denote the current *state of the world* (which summarizes the current political and economic situation). While $\overline{T}$ is constant, we assume that the state of the world evolves over time according to an independently and identically distributed (i.i.d.) stochastic process σ with state space S and probability distribution function $F_\sigma(\cdot)$.

After the resignation of an incumbent government, the head of state chooses one of the parties represented in the parliament to try to form a new government.

[7] The shares are determined by the outcome of a general election that is not modelled here.

[8] For a richer, spatial model of government formation where government policies are endogenously determined, see Diermeier and Merlo (2000).

We refer to the selected party $k \in N$ as the *formateur*. Following Laver and Shepsle (1996) and Baron (1991, 1993), we assume that the choice of a formateur is nonpartisan and the head of state is nonstrategic.[9] In particular, we assume that each party $i \in N$ is selected to be a formateur with probability

$$(3) \qquad p_i(\pi, k_{-1}) = \begin{cases} 1 & \text{if } \pi_i \geq 0.5, \\ \dfrac{\exp(\alpha_0 \pi_i + \alpha_1 I_i)}{\sum_{j \in N} \exp(\alpha_0 \pi_j + \alpha_1 I_j)} & \text{if } \pi_j < 0.5, \forall j \in N, \\ 0 & \text{if } \exists\, j \neq i : \pi_j \geq 0.5, \end{cases}$$

where $k_{-1} \in N$ denotes the party of the former prime minister, and I_i is a dummy variable that takes the value 1 if $k_{-1} = i$ and zero otherwise. This specification captures the intuition that although relatively larger parties may be more likely to be selected as a formateur than relatively smaller parties, there may be an incumbency bias. It also reflects the fact that if a party has an absolute majority in parliament, then it has to be selected as the formateur.

The formateur then chooses a *proto-coalition* $D \in \Delta_k$, where Δ_k denotes the set of subsets of N that contain k.[10] Intuitively, a proto-coalition is a set of parties that agree to talk to each other about forming a government together. Let $\pi^D \equiv \sum_{i \in D} \pi_i$ denote the *size* of proto-coalition D. The proto-coalition bargains over the formation of a new government, which determines the allocation of government portfolios among the coalition members, $x^D = (x_i^D)_{i \in D} \in \mathbb{R}_+^{|D|}$. Following Merlo (1997), we assume that cabinet portfolios generate a (perfectly divisible) unit level of surplus in every period a government is in power and we let $T^D \in [0, \overline{T}]$ denote the duration of a government formed by proto-coalition D.

Government duration in parliamentary democracies is not fixed. Rather, it is a variable that depends on institutional factors (such as, for example, whether an investiture vote is required to form a government, whether a government needs to maintain the active support of a parliamentary majority, and the rules for tabling a vote of no-confidence), the relative size of the government coalition, the time horizon to the next election, the state of the political and economic system at the time a government forms, and political and economic events occurring while a government is in power (see, e.g., King et al. (1990), Merlo (1998), and Warwick (1994)). Let Q denote the vector of institutional characteristics (possibly) affecting government duration. Hence, T^D can be represented as a random variable with density function $f(t^D | s, \overline{T}, Q, \pi^D)$ over the support $[0, \overline{T}]$.[11]

[9] Note that constitutions are typically silent with respect to the rules for selecting a formateur, which are generally reflected in unwritten conventions and norms. This is the case for all the countries we consider. An exception is represented by Greece (which is not in our data set), where the constitution prescribes that the party that controls the largest fraction of parliamentary seats must be chosen as the formateur.

[10] Our assumption that parties always prefer to be included in the government coalition immediately implies that the formateur party will never propose a proto-coalition that does not include itself.

[11] In this paper, we treat government dissolution as exogenous. This assumption makes the estimation of the model feasible. For a theoretical model where the decision of dissolving a government is endogenous, see Diermeier and Merlo (2000).

Given the current state s and the vector of (time-invariant) characteristics $(\overline{T}, Q, \pi^D)$, let

$$y^D(s, \overline{T}, Q, \pi^D) \equiv E[T^D | s, \overline{T}, Q, \pi^D] \tag{4}$$

denote the *cake* to be divided among the members of the proto-coalition D if they agree to form a government in that state. That is, $y^D(\cdot) \in (0, \overline{T})$ represents the total expected benefits from forming a government in state s. Given proto-coalition D, for any state s, let

$$X^D(s, \overline{T}, Q, \pi^D) \equiv \left\{ x^D \in \mathbb{R}_+^{|D|} : \sum_{i \in D} x_i^D \leq y^D(s; \overline{T}, Q, \pi^d) \right\} \tag{5}$$

denote the set of feasible payoff vectors to be allocated in that state, where x_i^D is the amount of cake awarded by coalition D to party $i \in D$.

The bargaining game proceeds as follows. Given state s, the formateur chooses either to pass or to propose an allocation $x^D \in X^D(s; \overline{T}, Q, \pi^D)$. If k proposes an allocation, all the other parties in the proto-coalition sequentially respond by either accepting or rejecting the proposal until either some party has rejected the offer or all parties in D have accepted it. If the proposal is unanimously accepted by the parties in the proto-coalition, a government is inaugurated and the game ends. If no proposal is offered and accepted by all parties in the proto-coalition, state s' is realized according to the stochastic process σ and party $i \in D$ is selected to make a government proposal with probability

$$\tilde{p}_i(\pi, D) = \begin{cases} 1 & \text{if } \pi_i \geq 0.5, \\ \dfrac{\exp(\alpha_2 \pi_i)}{\sum_{j \in D} \exp(\alpha_2 \pi_j)} & \text{if } \pi_j < 0.5, \forall j \in D, \\ 0 & \text{if } \exists\, j \neq i : \pi_j \geq 0.5. \end{cases} \tag{6}$$

Let $\ell \in D$ denote the identity of the proposer. The bargaining process continues until some proposed allocation is unanimously accepted by the parties in the proto-coalition.

An outcome of this bargaining game (τ^D, χ^D) may be defined as a stopping time $\tau^D = 0, 1, \ldots$ and a $|D|$-dimensional random vector χ^D that satisfies $\chi^D \in X^D(\sigma_{\tau^D}, \overline{T}, Q, \pi^D)$ if $\tau^D < +\infty$ and $\chi^D = 0$ otherwise. Given a realization of σ, τ^D denotes the period in which a proposal is accepted by proto-coalition D, and χ^D denotes the proposed allocation that is accepted in state σ_{τ^D}. Define $\beta^\infty = 0$. Then an outcome (τ^D, χ^D) implies a von Neumann-Morgenstern payoff to each party $i \in D$ equal to $E[\beta^{\tau^D} \chi_i^D] + \varepsilon_i^D$, and a payoff to each party $j \in N \backslash D$ equal to η_j^D. Let

$$V_k(D, \overline{T}, Q, \pi^D) \equiv E[\beta^{\tau^D} \chi_i^D]. \tag{7}$$

For any formateur $k \in N$, each potential proto-coalition $D \in \Delta_k$ is associated with an expected payoff for party k

$$W_k(D, \overline{T}, Q, \pi^D) = V_k(D, \overline{T}, Q, \pi^D) + \varepsilon_k^D. \tag{8}$$

Hence, party k chooses the proto-coalition to solve

$$\max_{D \in \Delta_k} W_k(D, \overline{T}, Q, \pi^D). \tag{9}$$

Let $D_k \in \Delta_k$ denote the solution to this maximization problem.

2.1. *Equilibrium Characterization*

The bargaining model described above is a special case in the class of stochastic bargaining games studied by Merlo and Wilson (1995, 1998). In particular, the unique stationary subgame perfect equilibrium to this game has the following features. First, the equilibrium agreement rule possesses a *reservation property*: In any state s, coalition D agrees in that state if and only if $y^D(s, \overline{T}, Q, \pi^D) \geq y^*(D, \overline{T}, Q, \pi^D)$, where $y^*(\cdot)$ solves

$$y^*(D, \overline{T}, Q, \pi^D) = \beta \int \max\{y^D(s', \overline{T}, Q, \pi^D), y^*(D, \overline{T}, Q, \pi^D)\}\, dF_\sigma(s'). \tag{10}$$

Hence, delays can occur in equilibrium. During proto-coalition bargaining, the reservation property implies a trade-off between delay in the formation process and expected duration. Intuitively, coalitions may want to wait for a favorable state of the world that is associated with a longer expected government duration and hence a larger cake. On the other hand, the presence of discounting makes delay costly. In equilibrium, agreement is reached when these opposite incentives are balanced. Notice that the role of delays is to "screen out" relatively unstable governments. How much screening occurs in equilibrium depends on how impatient parties are (measured by β), their institutional environment (summarized by Q), the length of the time horizon to the next scheduled election (given by $\overline{T}$), the size and composition of the proto-coalition (equal to π^D and D, respectively), and the uncertainty about the future (summarized by the stochastic process σ).

Second, the equilibrium of the bargaining game satisfies the *separation principle* (Merlo and Wilson (1998)): Any equilibrium payoff vector must be Pareto efficient, and the set of states where parties agree must be independent of the proposer's identity. This implies that in the proto-coalition bargaining stage, distribution and efficiency considerations are independent and delays are optimal from the point of view of the parties in the proto-coalition. In particular, perpetual disagreement is never an equilibrium, and for any possible proto-coalition, agreement is reached within a finite amount of time. Hence, for any $D \in \Delta_k$, if D is chosen as the proto-coalition, then D forms the government.

Third, using the general characterization theorems contained in Merlo and Wilson (1995, 1998), we obtain that for any formateur $k \in N$ and for any potential proto-coalition $D \in \Delta_k$, the ex-ante expected equilibrium payoff to party k is given by

$$W_k(D, \overline{T}, Q, \pi^D) = V_k(D, \overline{T}, Q, \pi^D) + \varepsilon_k^D, \tag{11}$$

where

$$V_k(D,\overline{T},Q,\pi^D)=\left(\frac{1-\beta(1-\tilde{p}_k(\pi,D))}{1-\beta}\right) \times\int\max\{y^D(s,\overline{T},Q,\pi^D)-y^*(D,\overline{T},Q,\pi^D),0\}\,dF_\sigma(s). \tag{12}$$

Using equations (10) and (12) and simplifying, equation (11) reduces to

$$W_k(D,\overline{T},Q,\pi^D)=\left(\frac{1-\beta(1-\tilde{p}_k(\pi,D))}{\beta}\right)y^*(D,\overline{T},Q,\pi^D)+\varepsilon_k^D. \tag{13}$$

Hence, we obtain that for any formateur $k\in N$, the equilibrium proto-coalition choice $D_k\in\Delta_k$ is given by

$$D_k=\arg\max_{D\in\Delta_k}\left(\frac{1-\beta(1-\tilde{p}_k(\pi,D))}{\beta}\right)y^*(D,\overline{T},Q,\pi^D)+\varepsilon_k^D, \tag{14}$$

and D_k forms the government (that is, $G=D_k$). When choosing a government coalition, a formateur faces a trade-off between "control" (i.e., its own share of the cake) and "durability" (i.e., the overall size of the cake). That is, on the one hand, relatively larger coalitions may be associated with longer expected durations and hence relatively larger cakes. On the other hand, because of proto-coalition bargaining, by including additional parties in its coalition the formateur party would receive a smaller share of the cake. The equilibrium coalition choice depends on the terms of this trade-off, which in turn, given the institutional environment Q, depend on the relative desirability of the different options $y^*(\cdot)$, the degree of impatience of the formateur β, its relative "bargaining power" $\tilde{p}_k(\cdot)$, and the formateur's tastes for its coalition partners ε_k^D.

To further explore the intuition of the model and illustrate some of the properties of the equilibrium, we present a simple example. Suppose there are three parties of equal size, $N=\{1,2,3\}$ with $\pi=(1/3,1/3,1/3)$, and party 1 is the formateur. For each possible proto-coalition $D\in\Delta_1=\{\{1\},\{1,2\},\{1,3\},\{1,2,3\}\}$, if agreement is not reached on the first proposal, the probability party 1 is selected to make the next proposal is given by $\tilde{p}_1=1/|D|$. Let $\varepsilon_1^{\{1\}}=\varepsilon_1^{\{1,2\}}=1/2$ and $\varepsilon_1^{\{1,3\}}=\varepsilon_1^{\{1,2,3\}}=0$.

The time horizon to the next election is five periods, $\overline{T}=5$. There are two possible states of the world, $S=\{L,H\}$. Each state is realized with equal probability, $\Pr(\sigma=L)=\Pr(\sigma=H)=1/2$. The institutional environment, Q, is such that if $s=L$, then minority governments are expected to last one period, minimum winning governments are expected to last two periods, and surplus governments are expected to last three periods: that is, $y^{\{1\}}(L)=1$ and $y^{\{1,2\}}(L)=y^{\{1,3\}}(L)=2$ and $y^{\{1,2,3\}}(L)=3$. If, on the other hand, $s=H$, then minority governments are expected to last two periods, minimum winning governments are expected to last three periods, and surplus governments are expected to last four periods: that is, $y^{\{1\}}(H)=2$, $y^{\{1,2\}}(H)=y^{\{1,3\}}(H)=3$, and $y^{\{1,2,3\}}(H)=4$. This situation would

correspond, for example, to an environment where larger governments are relatively more durable and a "good" state of the world makes every government relatively more stable.

We begin by analyzing the outcome of proto-coalition bargaining for every possible proto-coalition $D \in \Delta_1$. Consider first the case where $D = \{1\}$. Using equation (10) above, it is easy to verify that if $\beta \leq 2/3$, then

$$y^*(\{1\}) = \frac{3\beta}{2} \leq y^{\{1\}}(L),$$

which implies that delays never occur. If, on the other hand, $\beta > 2/3$, then

$$y^*(\{1\}) = \frac{2\beta}{2-\beta} > y^{\{1\}}(L),$$

which implies that delays occur when $s = L$. Hence, using equation (13) above, the equilibrium payoff to party 1 from choosing proto-coalition $\{1\}$ is equal to

$$W_1(\{1\}) = \begin{cases} 2 & \text{if } \beta \leq \frac{2}{3}, \\ \dfrac{2}{2-\beta} + \dfrac{1}{2} & \text{if } \beta > \frac{2}{3}. \end{cases}$$

Next, consider the cases where $D = \{1, 2\}$ or $D = \{1, 3\}$. It is easy to verify that if $\beta \leq 4/5$, then

$$y^*(\{1, 2\}) = y^*(\{1, 3\}) = \frac{5\beta}{2} > y^{\{1,2\}}(L) = y^{\{1,3\}}(L),$$

which implies that agreement occurs in both states of the world. If, on the other hand, $\beta > 4/5$, then

$$y^*(\{1, 2\}) = y^*(\{1, 3\}) = \frac{3\beta}{2-\beta} > y^{\{1,2\}}(L) = y^{\{1,3\}}(L),$$

which implies that agreement only occurs when $s = H$. Hence, the equilibrium payoff to party 1 from choosing proto-coalition $\{1, 2\}$ is equal to

$$W_1(\{1, 2\}) = \begin{cases} \dfrac{5(2-\beta)}{4} + \dfrac{1}{2} & \text{if } \beta \leq \frac{4}{5}, \\ 2 & \text{if } \beta > \frac{4}{5}, \end{cases}$$

and its equilibrium payoff from choosing proto-coalition $\{1, 3\}$ is equal to

$$W_1(\{1, 3\}) = \begin{cases} \dfrac{5(2-\beta)}{4} & \text{if } \beta \leq \frac{4}{5}, \\ \dfrac{3}{2} & \text{if } \beta > \frac{4}{5}. \end{cases}$$

Finally, consider the case where $D = \{1, 2, 3\}$. It is easy to verify that if $\beta \leq 6/7$, then

$$y^*(\{1, 2, 3\}) = \frac{7\beta}{2} \leq y^{\{1,2,3\}}(L),$$

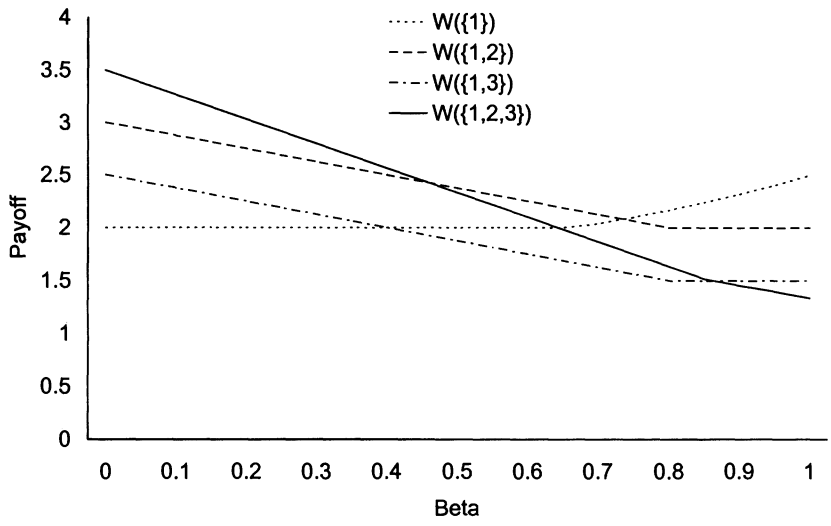

FIGURE 1.—Formateur's equilibrium payoffs.

which implies that agreement occurs in both states of the world. If, on the other hand, $\beta > 6/7$, then

$$y^*(\{1,2,3\}) = \frac{4\beta}{2-\beta} > y^{\{1,2,3\}}(L),$$

which implies that agreement only occurs when $s = H$. Hence, the equilibrium payoff to party 1 from choosing proto-coalition $\{1,2,3\}$ is equal to

$$W_1(\{1,2,3\}) = \begin{cases} \dfrac{7(3-2\beta)}{6} & \text{if } \beta \leq \frac{6}{7}, \\ \dfrac{4(3-2\beta)}{6-3\beta} & \text{if } \beta > \frac{6}{7}. \end{cases}$$

The equilibrium payoffs to the formateur party 1 associated with all possible proto-coalitions are depicted in Figure 1 as functions of the parameter β.

Hence, the equilibrium proto-coalition choice of the formateur party 1 is given by:[12]

$$D_1 = \begin{cases} \{1,2,3\} & \text{if } \beta \in (0, 0.46), \\ \{1,2\} & \text{if } \beta \in (0.46, 0.74), \\ \{1\} & \text{if } \beta \in (0.74, 1). \end{cases}$$

A relatively high degree of impatience would induce the formateur to choose a surplus coalition that would immediately agree to form the government.[13] On

[12] We are ignoring here the event of a tie between two alternatives. As it will become clear in Section 4 below, ties are zero probability events.

[13] Notice that when $D = \{1,2,3\}$ and $\beta \in (0, 0.46)$ agreement occurs in both states of the world.

average, surplus governments would therefore be observed to last 3.5 periods. For intermediate levels of impatience, on the other hand, the formateur would choose a minimum winning coalition. Even in this case, however, the process of government formation would involve no delay and would produce governments that would last, on average, 2.5 periods. Finally, for sufficiently low degrees of impatience, the formateur would choose a minority government that would wait to assume office until the "good" state of the world is realized and would last, on average, 2 periods. Notice that the least durable governments (that is, minority governments that come to power in a "bad" state of the world) are "screened out" in equilibrium and would never form. Also, notice that at the basis of these results is the fundamental trade-off we described above between "durability" (i.e., larger coalitions are typically more durable and hence are associated with larger cakes) and "control" (i.e., larger coalitions imply smaller shares of the cake for each coalition member) that drives the equilibrium selection of government coalitions subject to the institutional constraints.

To understand the role played by institutions on the equilibrium selection of government coalitions, consider now a different institutional environment, Q', such that $y^{\{1\}}(L) = y^{\{1,2\}}(L) = y^{\{1,3\}}(L) = y^{\{1,2,3\}}(L) = 1$ and $y^{\{1\}}(H) = y^{\{1,2\}}(H) = y^{\{1,3\}}(H) = y^{\{1,2,3\}}(H) = 2$, while holding everything else constant. This situation would correspond, for example, to an environment where the size of the government coalition does not affect its duration but a "good" state of the world makes a government relatively more stable. In this case, it is easy to verify that for every possible proto-coalition $D \in \Delta_1$, if $\beta \leq 2/3$, then

$$y^*(D) = \frac{3\beta}{2} \leq y^D(L),$$

which implies that agreement occurs in both states of the world. If, on the other hand, $\beta > 2/3$, then

$$y^*(D) = \frac{2\beta}{2-\beta} > y^D(L),$$

which implies that agreement only occurs when $s = H$. Thus, the equilibrium payoffs to party 1 from choosing each proto-coalition are equal to

$$W_1(\{1\}) = \begin{cases} 2 & \text{if } \beta \leq \frac{2}{3}, \\ \dfrac{2}{2-\beta} + \dfrac{1}{2} & \text{if } \beta > \frac{2}{3}, \end{cases}$$

$$W_1(\{1,2\}) = \begin{cases} \dfrac{3(2-\beta)}{4} + \dfrac{1}{2} & \text{if } \beta \leq \frac{2}{3}, \\ \dfrac{3}{2} & \text{if } \beta > \frac{2}{3}, \end{cases}$$

$$W_1(\{1,3\}) = \begin{cases} \dfrac{3(2-\beta)}{4} & \text{if } \beta \leq \frac{2}{3}, \\ 1 & \text{if } \beta > \frac{2}{3}, \end{cases}$$

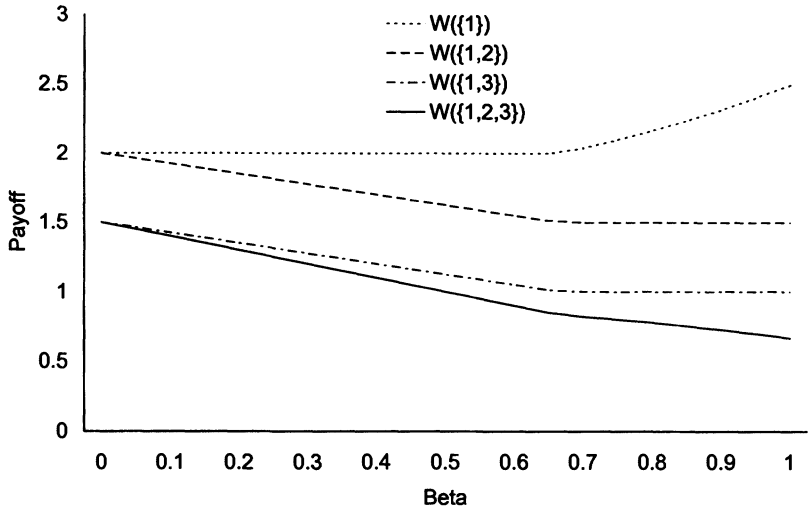

FIGURE 2.—Formateur's equilibrium payoffs.

$$W_1(\{1,2,3\}) = \begin{cases} \dfrac{3-2\beta}{2} & \text{if } \beta \leq \frac{2}{3}, \\ \dfrac{2(3-2\beta)}{3(2-\beta)} & \text{if } \beta > \frac{2}{3}, \end{cases}$$

and are depicted in Figure 2 as functions of the parameter β.

Thus, in this case, the equilibrium proto-coalition choice of the formateur party 1 is independent of β and is equal to $D_1 = \{1\}$. In the institutional environment considered here, larger government coalitions do not induce longer durations. By including additional parties in its coalition, the formateur party would only reduce its share of the cake without increasing the overall size of the cake. These considerations induce the formation of minority governments. Unlike in the previous institutional environment, a high degree of impatience does not lead to the formation of majority governments. The only role played by impatience here is to either induce or discourage delays (that would be observed in the "bad" state of the world if $\beta > 2/3$), and hence affect the distribution of observed government duration.[14]

As evidenced in this example, our model is fairly general and is capable of addressing the issues we discussed in the Introduction. However, it should also be clear from the example that the predictions of the model critically depend on the values of the model's parameters. In order to assess quantitatively the effects of specific institutional features of parliamentary democracy on the formation and dissolution of coalition governments and evaluate counterfactual constitutional experiments we estimate our structural model using a newly collected data set, to which we turn our attention next.

[14] Notice that in this example, the average duration of governments would be either 1.5 or 2 periods, depending on whether or not $\beta \leq 2/3$.

3. DATA

Our sample of observations consists of 255 governments in 9 West European countries over the period 1947–1999. The countries we consider are Belgium (34 governments), Denmark (30 governments), Finland (29 governments), Germany (24 governments), Iceland (21 governments), Italy (46 governments), Netherlands (20 governments), Norway (25 governments), and Sweden (26 governments). All these countries have been parliamentary democracies since World War II and elect their parliament according to proportional representation. They differ, however, with respect to specific institutional features that affect the way governments form and terminate.

A first difference concerns whether the government needs an actual vote by the parliament to legally assume office (the investiture vote), or whether it can simply assume office after being appointed by the head of state (i.e., either a monarch or a president). In Belgium (until 1995) and Italy, after a new government is inaugurated, it has to be approved by a parliamentary majority. The other countries considered here do not have such a requirement.

A second distinction concerns whether to remain in power the government needs the continued, explicit support of a parliamentary majority (positive paliamentarism), or whether the lack of opposition by a parliamentary majority is sufficient (negative parliamentarism). In Denmark, Norway, and Sweden, governments can be sustained as long as there is no explicit majority vote of opposition in parliament. In other words, the government is assumed to have the confidence of the parliament until the opposite has been demonstrated. In the other countries considered here, this is not the case. In particular, to remain in office the government must maintain the active support of a parliamentary majority (for example, supporting all major legislative initiatives by the government like the budget) and not just be tolerated by parliament.

A third distinction concerns whether the government can simply be voted out of office through a no-confidence vote in the parliament, or whether it needs to be immediately replaced by an alternative government (the constructive vote of no-confidence). In all parliamentary democracies, each party represented in parliament can at any time table a vote of no-confidence. In all countries except Germany (and, since 1995, Belgium), the government has to resign if defeated by a parliamentary majority leading to a new government formation process. In Germany and, more recently, in Belgium, on the other hand, a parliamentary majority must not only depose the current government but also simultaneously elect an alternative government that must be specified before the vote takes place.

A fourth difference, concerns the time horizon faced by the government. In Norway and Sweden, elections must be held at predetermined intervals (fixed interelection period). The constitutions of the other countries considered here, on the other hand, admit the possibility of dissolving parliament before the

TABLE I
INSTITUTIONS

Country	INVEST	NEG	CCONF	FIXEL
Belgium[a]	1	0	1	0
Denmark	0	1	0	0
Finland	0	0	0	0
Germany	0	0	1	0
Iceland	0	0	0	0
Italy	1	0	0	0
Netherlands	0	0	0	0
Norway	0	1	0	1
Sweden	0	1	0	1

[a] In 1993, Belgium amended its constitution by abolishing the investiture vote and introducing the constructive vote of no-confidence. This constitutional reform went into effect after the 1995 election.

expiration of the parliamentary term (the duration of which varies across countries) and starting a new term by calling early elections.[15]

Let *INVEST* be a dummy variable that takes the value one if a country requires an investiture vote and zero otherwise, *NEG* a dummy variable that takes the value one if a country has a negative form of parliamentarism and zero otherwise, *CCONF* a dummy variable that takes the value one if a country requires a vote of no-confidence to be constructive and zero otherwise, and *FIXEL* a dummy variable that takes the value one if a country has a fixed interelection period and zero otherwise. Table I summarizes the institutional environment for each of the nine countries in our data set.

An observation in the sample is defined by the identity of the formateur party, k, the composition of the proto-coalition, D_k, the duration of the negotiation over the formation of a new government (i.e., the number of attempts), τ^{D_k}, the sequence of proposers (one for each attempt) if the formateur does not succeed to form the government at the first attempt, $\ell_2, \ldots, \ell_{\tau^{D_k}}$, and the duration of the government following that negotiation (i.e., the number of days the government remains in power), t^{D_k}. For each element in the sample we also observe the vector of institutional characteristics, $Q = (INVEST, NEG, CCONF, FIXEL)$, the time horizon to the next scheduled election, $\overline{T}$, the set of parties represented in the parliament, N, the vector of their relative seat shares, π, and the party of the former prime minister, k_{-1}.

Keesings Record of World Events (1944–present) was used to collect information on the number of attempts for each government formation, the identity of the proposer on each attempt, the time horizon to the next election, and the duration of the government following each negotiation.[16] The list of parties represented

[15] In principle, early elections can also be called in Sweden. However, they are not a substitute for regularly scheduled elections. In particular, early elections cannot start a new parliamentary term. In practice, this feature makes early elections irrelevant in Sweden.

[16] Several other country-specific sources (such as local newspapers and databases) were used to confirm dubious entries in Keesings.

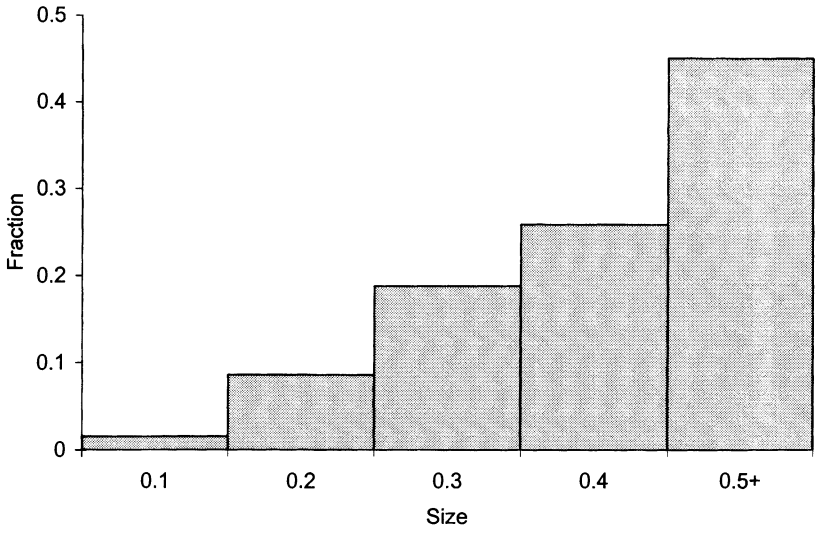

FIGURE 3.—Histogram of formateur size.

in the parliament for each country and their shares of parliamentary seats at the time of each negotiation over the formation of a new government was taken from Mackie and Rose (1990) and, for later years in the sample, from *Keesings*, the *European Journal of Political Research*, and the *Lijphart Elections Archives*.[17] Institutional characteristics of the countries included in our study were obtained from Lijphart (1984), Muller and Strom (2000), and from the Constitution of each country.

Figures 3–6 present an overview of the main aggregate features of our data. Figure 3 depicts the histogram of the size (i.e., the seat share) of the parties selected as formateur.[18] As we can see from this figure, there is a positive relation between a party's size and its recognition probability: Larger parties are more likely to be selected as formateur than smaller parties. Data on the duration of negotiations are summarized in the histogram contained in Figure 4. As we can see from this figure, 62% of all government formations in our sample occur at the first attempt and 96% of all government formations require no more than four attempts. Data on government durations are summarized in the histogram displayed in Figure 5. Most governments either fall early in their tenure or they tend to last until the next scheduled election. About 38% of all governments in the sample last less than one year, and about 21% of all governments last their maximum potential duration.[19] Data on the size of government coalitions are

[17] The archive is available online at http://dodgson.ucsd.edu/lij.

[18] The last bin of the histogram includes parties whose seat share is larger than 40%. There are a few instances (22 observations) where a party controls an absolute majority of the parliamentary seats. In these cases the majority party is always selected as the formateur.

[19] Some of the short durations can be explained by governments failing their investiture vote in Belgium or in Italy.

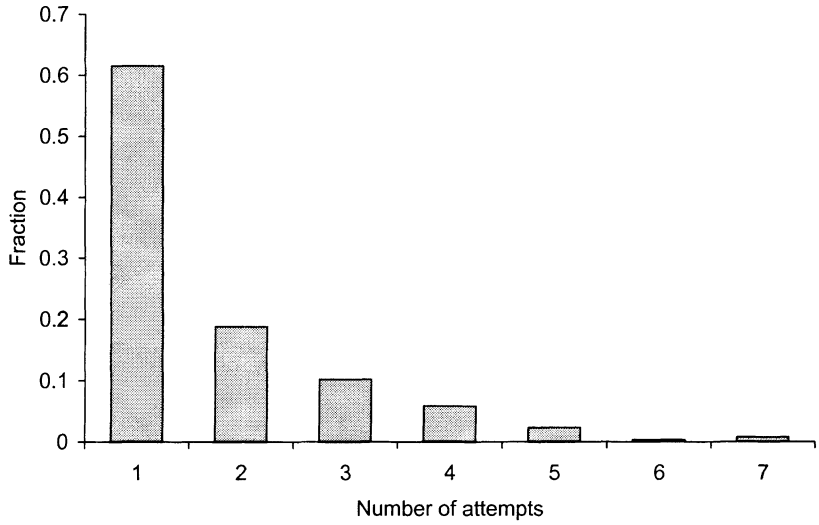

FIGURE 4.—Histogram of negotiation duration.

summarized in the histogram contained in Figure 6. About 61% of all government coalitions control between 40% and 60% of the parliamentary seats. Only about 6% of all government coalitions control either less than 20% or more than 80% of the parliamentary seats.

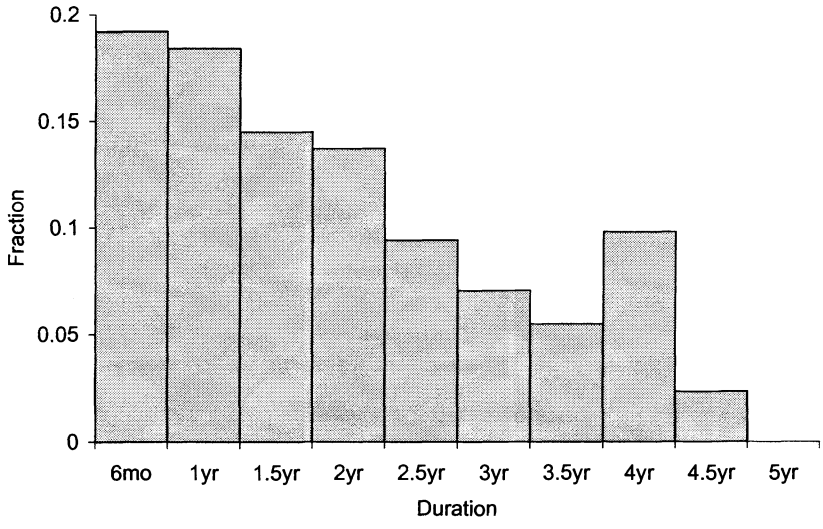

FIGURE 5.—Histogram of government duration.

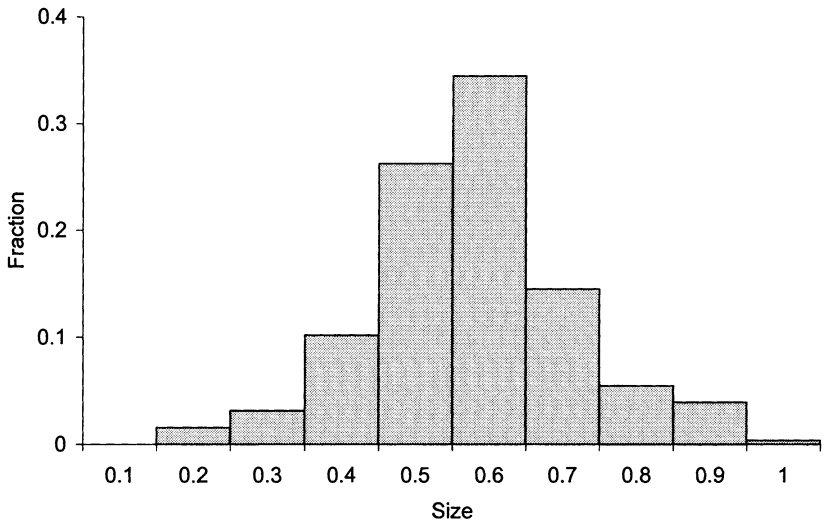

FIGURE 6.—Histogram of government size.

Descriptive statistics of all the variables are reported in Table II, where *MINORITY* is a dummy variable that takes the value one if the government coalition is a minority coalition (i.e., it controls less than 50% of the parliamentary seats) and zero otherwise, *MAJORITY* is a dummy variable that takes the value one if the government coalition is a majority coalition (i.e., it controls at least 50% of the parliamentary seats) and zero otherwise, *MINWIN* is a dummy variable that takes the value one if the government coalition is a minimum winning

TABLE II

DESCRIPTIVE STATISTICS

Variable	Mean	Standard Deviation	Minimum	Maximum
Number of Attempts	1.73	1.16	1	7
Government Duration (Days)	602.85	438.82	7	1637
Time to Next Election (Days)	1161.67	404.22	79	1825
Number of Parties	6.70	2.10	3	13
Size of Government Coalition (%)	52.71	13.35	11.20	90.1
MINORITY	0.40	0.49	0	1
MAJORITY	0.60	0.49	0	1
MINWIN	0.36	0.48	0	1
SURPLUS	0.24	0.43	0	1
INVEST	0.31	0.46	0	1
NEG	0.32	0.47	0	1
CCONF	0.10	0.30	0	1
FIXEL	0.20	0.40	0	1

TABLE III
GOVERNMENT FORMATION AND DURATION

Country	Mean Number of Attempts	Mean Government Duration (Days)	Mean Government Size (%)
Belgium	2.4	495	62
Denmark	1.8	626	41
Finland	1.8	509	55
Germany	1.1	727	57
Iceland	1.6	802	55
Italy	1.8	321	51
Netherlands	2.6	810	62
Norway	1.1	755	47
Sweden	1.2	740	47
Average	1.7	603	53

majority coalition (i.e., removing any of the parties from the coalition would always result in a minority coalition), and *SURPLUS* is a dummy variable that takes the value one if the government coalition is a surplus majority coalition (i.e., it is possible to remove at least one party from the coalition without resulting in a minority coalition) and zero otherwise. Note that 40% of the governments in our sample are minority governments, 36% are minimum winning coalitions, and the remaining 24% are surplus coalitions. Minority governments are on average less stable than majority governments (the mean government duration is equal to 469 days for minority governments and 694 days for majority governments). Furthermore, minimum winning governments are on average more stable than surplus governments (their mean government durations are equal to 776 and 568 days, respectively).

West European countries differ with respect to the composition of their government coalitions, the duration of their government formation processes, and the durability of their governments. Tables III and IV illustrate these differences

TABLE IV
DISTRIBUTION OF GOVERNMENT TYPES

Country	% Minority Governments	% Minimum Winning Governments	% Surplus Governments
Belgium	12	70	18
Denmark	83	17	0
Finland	31	14	55
Germany	12	71	17
Iceland	19	71	10
Italy	48	2	50
Netherlands	15	40	45
Norway	64	36	0
Sweden	65	35	0
Average	40	36	24

by reporting the average number of formation attempts, the average government duration, and the average size of the government coalition (Table III), and the distribution of minority, minimum winning, and surplus governments (Table IV), for each country in our data set as well as for the entire sample.

Several observations emerge from these tables. While minority governments account for 40% of all governments in our sample, the fraction of minority governments varies from 12% in Belgium and Germany to 83% in Denmark. A similar variation is observed in the fraction of surplus governments (which compose about one fourth of all governments in our sample), that varies from 0% in Denmark, Norway, and Sweden, to 55% in Finland. These differences in the distribution of government types across countries contribute to explain the variation we observe in the average size of the government coalition, that ranges from 41% in Denmark to 62% in Belgium and the Netherlands.

West European parliamentary democracies also differ with respect to the duration of their governments. The average government duration ranges from a little less than a year in Italy to about 2.2 years in the Netherlands. Average government durations above two years are also observed in Iceland, Germany, Norway, and Sweden. There is also some variation in the time it takes until a government forms. While almost all negotiations in Germany, Norway, and Sweden succeed during the first attempt, government formations in the Netherlands are on average longer (the average number of attempts is above 2) and may require as many as seven attempts. However, the cross-country variation in the duration of the government formation process is fairly limited.

4. ECONOMETRIC SPECIFICATION

In the bargaining model described in Section 2, we specified the cake over which a generic proto-coalition D bargains in any given period, y^D, to be equal to the expected government duration conditional on the state of the world in that period, s, given the vector of (time-invariant) characteristics, $(\overline{T}, Q, \pi^D)$. Also, we characterized the conditions under which agreement occurs in terms of a reservation rule on the size of the current cake. Hence, from the perspective of the political parties that observe the cakes, the sequence of events in a negotiation is deterministic, since they agree to form a government as soon as the current cake is above a threshold that depends only on their expectation about future states of the world and hence future cakes. The only uncertainty concerns the actual duration of the government following the agreement, T^D, which also depends on future events occurring while the government is in power. Thus, T^D is a random variable.

We (the econometricians), however, do not observe the state of the world s.[20] Hence, from the perspective of the econometrician, the cake $y^D(s, \overline{T}, Q, \pi^D) \equiv$

[20] In particular, we do not observe all the relevant elements in the parties' information set when they form their expectations about government durations. Thus, we do not observe the cake.

$E[T^D|s, \overline{T}, Q, \pi^D)$ is also a random variable.[21] Let $F_y(y^D|\overline{T}, Q, \pi^D)$ denote the conditional distribution of cakes with conditional density $f_y(\cdot|\cdot)$ defined over the support $[0, \bar{y}]$, and let $F_T(t^D|y^D; \overline{T}, Q, \pi^D)$ denote the conditional distribution of government durations with conditional density $f_T(\cdot|\cdot)$ defined over the support $[0, \overline{T}]$, where $\bar{y} < \overline{T}$ is the upper bound on the expectations over government duration and $F_T(\cdot|\cdot)$ satisfies the restriction $E[T^D|y^D; \overline{T}, Q, \pi^D] = y^D$.[22] Thus, from the point of view of the econometrician, $y^*(D, \overline{T}, Q, \pi^D)$ solves

$$(15) \qquad y^* = \beta \int \max\{y^D, y^*\}\, dF_y(y^D|\overline{T}, Q, \pi^D)$$
$$= \beta\left(E[y^D|\overline{T}, Q, \pi^D] + \int_0^{y^*} (y^* - y^D)\, dF_y(y^D|\overline{T}, Q, \pi^D)\right),$$

and the probability of a negotiation lasting τ rounds is equal to

$$(16) \qquad \Pr(\tau) = [\Pr(y^D < y^*(D, \overline{T}, Q, \pi^D))]^{\tau-1} \Pr(y^D \geq y^*(D, \overline{T}, Q, \pi^D))$$
$$= [F_y(y^*(\cdot)|\overline{T}, Q, \pi^D)]^{\tau-1}[1 - F_y(y^*(\cdot)|\overline{T}, Q, \pi^D)].$$

This is the probability that the first $\tau - 1$ cakes are smaller than the threshold $y^*(D, \overline{T}, Q, \pi^D)$ and the cake in period τ is greater than or equal to $y^*(D, \overline{T}, Q, \pi^D)$. Moreover, the probability of a government duration t following an agreement after τ rounds of negotiations is equal to

$$(17) \qquad \Pr(t|\tau) = \Pr(t|y^D \geq y^*(D, \overline{T}, Q, \pi^D))$$
$$= \frac{\int_{y^*(\cdot)}^{\bar{y}} f_T(t|y^D; \overline{T}, Q, \pi^D)\, dF_y(y^D|\overline{T}, Q, \pi^D)}{1 - F_y(y^*(\cdot)|\overline{T}, Q, \pi^D)}.$$

Agreement implies that the expected government duration is above the threshold $y^*(D, \overline{T}, Q, \pi^D)$. However, we (the econometricians) do not know exactly which cake induced the agreement. Hence, in order to compute this probability, we have to average over all the possible cakes that may have induced the agreement.

Let us now consider the decision problem faced by the formateur party k. For each possible coalition $D \in \Delta_k$, party k can compute its expected equilibrium payoff if D is chosen as the proto-coalition and bargains over the formation of a new government. The formateur's expected payoff is given in equation (13) and depends on the expected outcome of the bargaining process as well as the formateur's tastes for its coalition partners, ε_k^D. Hence, from the perspective of the formateur party that knows its tastes, the optimal coalition choice described in equation (14) is deterministic. We (the econometricians), however,

[21] Since, by assumption, s is i.i.d., y^D is also i.i.d.. The assumption that the state of the world follows an i.i.d. stochastic process is critical to obtain the simple equilibrium characterization described in Section 2.1 above, which makes the estimation of the model feasible.

[22] Note that $F_y(y^D|\overline{T}, Q, \pi^D)$ and $F_T(t^D|y^D; \overline{T}, Q, \pi^D)$ imply a distribution of T^D conditional on $(\overline{T}, Q, \pi^D)$.

do not observe the formateur's tastes for its coalition partners, ε_k^D. Hence, from the perspective of the econometrician, ε_k^D is a random variable. This implies that the expected payoff $W_k(D, \overline{T}, Q, \pi^D)$ is also a random variable, which in turn implies that the formateur's decision problem is probabilistic. Following McFadden (1973), Rust (1987), and many others, we assume that ε_k^D, $D \in \Delta_k$, are independently and identically distributed according to a type 1 extreme value distribution with standard deviation ρ.[23] Thus, from the point of view of the econometrician, the probability that the formateur party k chooses a particular proto-coalition $D' \in \Delta_k$ to form the government is given by

$$\begin{aligned}(18)\qquad \Pr(D') &= \Pr(W_k(D', \overline{T}, Q, \pi^{D'}) > W_k(D', \overline{T}, Q, \pi^D), \forall D \in \Delta_k) \\ &= \frac{\exp\left(\frac{[1-\beta(1-\tilde{p}_k(\pi, D'))]y^*(D', \overline{T}, Q, \pi^{D'})}{\beta\rho}\right)}{\sum_{D\in\Delta_k}\exp\left(\frac{[1-\beta(1-\tilde{p}_k(\pi, D))]y^*(D, \overline{T}, Q, \pi^{D})}{\beta\rho}\right)}.\end{aligned}$$

We can now derive the likelihood function that represents the basis for the estimation of our structural model. The contribution to the likelihood function of each observation in the sample is equal to the probability of observing the vector of (endogenous) events $(k, D_k, \tau^{D_k}, \ell_2, \ldots, \ell_{\tau^{D_k}}, t^{D_k})$ conditional on the vector of (exogenous) characteristics $Z = (\overline{T}, Q, N, \pi, k_{-1})$, given the vector of the model's parameters $\theta = (\alpha_0, \alpha_1, \alpha_2, \beta, \rho, F_y, F_T)$. Given the structure of our model and our equilibrium characterization, this probability can be written as

$$\begin{aligned}(19)\qquad &\Pr(k, D_k, \tau^{D_k}, \ell_2, \ldots, \ell_{\tau^{D_k}}, t^{D_k}|Z; \theta) \\ &\quad = \Pr(k|Z; \theta)\Pr(D_k|k, Z; \theta)\Pr(\tau^{D_k}|D_k, k, Z; \theta) \\ &\qquad \times \Pr(\ell_2, \ldots, \ell_{\tau^{D_k}}|\tau^{D_k}, D_k, k, Z; \theta)\Pr(t^{D_k}|\tau^{D_k}, D_k, k, Z; \theta),\end{aligned}$$

where

$$\begin{aligned}&\Pr(k|Z; \theta) = p_k(\pi, k_{-1}; \alpha_0, \alpha_1), \\ &\Pr(D_k|k, Z; \theta) = \frac{\exp\left(\frac{[1-\beta(1-\tilde{p}_k(\pi, D_k; \alpha_3))]y^*(D_k, \overline{T}, Q, \pi^{D_k})}{\beta\rho}\right)}{\sum_{D\in\Delta_k}\exp\left(\frac{[1-\beta(1-\tilde{p}_k(\pi, D; \alpha_3))]y^*(D, \overline{T}, Q, \pi^{D})}{\beta\rho}\right)}, \\ &\Pr(\tau^{D_k}|D_k, k, Z; \theta) = [F_y(y^*(D_k, \overline{T}, Q, \pi^{D_k})|\overline{T}, Q, \pi^{D_k})]^{\tau^{D_k}-1} \\ &\qquad\qquad \times[1 - F_y(y^*(D_k, \overline{T}, Q, \pi^{D_k})|\overline{T}, Q, \pi^{D_k})], \\ &\Pr(\ell_2, \ldots, \ell_{\tau^{D_k}}|\tau^{D_k}, D_k, k, Z; \theta) = \prod_{j=2}^{\tau^{D_k}} \tilde{p}_{\ell_j}(\pi, D_k; \alpha_2),\end{aligned}$$

[23] For a detailed description of the properties of this family of distributions see, e.g., Johnson and Kotz (1970, Vol. 1, pp. 272–295).

and

$$\Pr(t^{D_k}|\tau^{D_k}, D_k, k, Z; \theta) = \frac{\int_{y^*(\cdot)}^{\bar{y}} f_T(t^{D_k}|y^{D_k}; \overline{T}, Q, \pi^{D_k})\, dF_y(y^{D_k}|\overline{T}, Q, \pi^{D_k})}{1 - F_y(y^*(D_k, \overline{T}, Q, \pi^{D_k})|\overline{T}, Q, \pi^{D_k})}.$$

The log-likelihood function is obtained by summing the logs of (19) over all the elements in the sample.[24]

The next step consists of choosing flexible parametric functional forms for $F_y(\cdot|\cdot)$ and $F_T(\cdot|\cdot)$. Following Merlo (1997), we assume that $F_y(\cdot|\cdot)$ and $F_T(\cdot|\cdot)$ belong to the family of beta distributions.[25] In particular, we let

$$f_y(y^D|\overline{T}, Q, \pi^D) = \gamma(\overline{T}, Q, \pi^D)\left[\frac{[y^D]^{\gamma(\overline{T},Q,\pi^D)-1}}{[\bar{y}(\overline{T}, Q)]^{\gamma(\overline{T},Q,\pi^D)}}\right], \tag{20}$$

$y^D \in [0, \bar{y}(\overline{T}, Q)]$, where

$$\begin{aligned}\gamma(\overline{T}, Q, \pi^D) = \exp((&\gamma_0 + \gamma_1\pi^D)MINORITY + (\gamma_2 + \gamma_3\pi^D)MINWIN \\ &+ (\gamma_4 + \gamma_5\pi^D)SURPLUS \\ &+ (\gamma_6 INVEST + \gamma_7 NEG + \gamma_8 CCONF)MINORITY \\ &+ (\gamma_9 INVEST + \gamma_{10} NEG + \gamma_{11} CCONF)MAJORITY \\ &+ (\gamma_{12} FIXEL + \gamma_{13}(1 - FIXEL))\overline{T}),\end{aligned} \tag{21}$$

and

$$\bar{y}(\overline{T}, Q) = \begin{cases} 0.9\overline{T} & \text{if } FIXEL = 1, \\ \dfrac{\exp(\lambda_0 + \lambda_1 INVEST)}{1 + \exp(\lambda_0 + \lambda_1 INVEST)} 0.9\overline{T} & \text{if } FIXEL = 0. \end{cases} \tag{22}$$

Furthermore, we let

$$\begin{aligned} f_T(t^D|y^D; \overline{T}, Q, \pi^D) = &\frac{1}{B\left(\frac{\delta(\overline{T},Q,\pi^D)y^D}{\overline{T}-y^D}, \delta(\overline{T}, Q, \pi^D)\right)} \\ &\times \left[\frac{[t^D]^{\frac{\delta(\overline{T},Q,\pi^D)y^D}{\overline{T}-y^D}-1}[\overline{T} - t^D]^{\delta(\overline{T},Q,\pi^D)-1}}{[\overline{T}]^{\frac{\delta(\overline{T},Q,\pi^D)y^D}{\overline{T}-y^D}+\delta(\overline{T},Q,\pi^D)-1}}\right], \end{aligned} \tag{23}$$

[24] Note that computing the likelihood function is a rather burdensome task since one has to enumerate all possible proto-coalitions and solve all possible bargaining games a formateur may choose to play. We thank Carl Coscia for developing the algorithm we use in our estimation.

[25] The family of beta distributions is the most flexible family of parametric distributions for continuous random variables with a finite support (see, e.g., Johnson and Kotz (1970, Vol. 1, pp. 37–56)). Some amount of experimentation with alternative specifications suggests that our results are not too sensitive to the specific parameterization chosen.

$t^D \in [0, \overline{T}]$, where $B(\cdot, \cdot)$ denotes the beta function and

$$\begin{aligned}(24)\qquad \delta(\overline{T}, Q, \pi^D) = \exp(&\delta_0 MINORITY + \delta_1 MINWIN + \delta_2 SURPLUS \\ &+ (\delta_3 INVEST + \delta_4 NEG + \delta_5 CCONF) MINORITY \\ &+ (\delta_6 INVEST + \delta_7 NEG + \delta_8 CCONF) MAJORITY \\ &+ (\delta_9 FIXEL + \delta_{10}(1 - FIXEL))\overline{T}).\end{aligned}$$

Notice that $f_T(\cdot|\cdot)$ satisfies the model restriction $E[T^D|y^D; \overline{T}, Q, \pi^D] = y^D$ since

$$E[T^D|y^D; \overline{T}, Q, \pi^D] = \left(\frac{\frac{\delta(\overline{T}, Q, \pi^D) y^D}{\overline{T} - y^D}}{\frac{\delta(\overline{T}, Q, \pi^D) y^D}{\overline{T} - y^D} + \delta(\overline{T}, Q, \pi^D)} \right) \overline{T} = y^D.$$

Several comments are in order. First, our parameterizations of $f_y(\cdot|\cdot)$ and $f_T(\cdot|\cdot)$ are highly flexible, and allow us to capture the (potential) effects of the institutional environment on the (expected and actual) duration of governments of different types in a fairly unrestricted way.[26] For example, minority governments may be expected to last less than majority governments in an environment characterized by an investiture vote or a constructive vote of no-confidence. On the other hand, this may not be the case in an environment where a government does not need to maintain the active support of a parliamentary majority to retain power. Also, government coalitions of different sizes may differ in their ability to cope with events even when exposed to similar shocks and, therefore, experience different outcomes.

Second, the specification described in equations (20)–(24) above also allows for the possibility that even government coalitions of the same size and in the same institutional environment may face different prospects with respect to their probability of survival depending on the time horizon ahead of them, $\overline{T}$. Moreover, the time horizon may have a different meaning in environments where the time between elections is fixed or it is uncertain. For example, in an environment where elections have to be held at predetermined intervals, $\overline{T}$ represents the natural benchmark for the upper bound on the expectations over government duration. On the other hand, in an environment where this is not the case, $\overline{T}$ may never be reached and other institutional features (such as whether an investiture vote can prematurely terminate a government) may also affect the range of expectations over government duration.[27]

[26] Notice that, by definition of beta distributions, $\gamma(\cdot)$ and $\delta(\cdot)$ must be strictly positive. This justifies the exponential functions in (21) and (24). Also, the lack of symmetry between the specifications of $\gamma(\cdot)$ and $\delta(\cdot)$ is justified by the fact that a likelihood ratio test cannot reject the current specification of $\delta(\cdot)$ in favor of an alternative specification that, like $\gamma(\cdot)$, includes three additional coefficients associated with π^D. Finally, to economize on the number of parameters, we restricted $F_y(\cdot|\cdot)$ to be a power-function distribution (i.e., a beta distribution with one parameter normalized to one).

[27] As shown in equation (22), we set the absolute upper bound on the expectations over the duration of a government to 90% of its maximum potential duration.

5. RESULTS

Table V presents the maximum likelihood estimates of the parameters of the model, $(\alpha, \beta, \gamma, \delta, \lambda, \rho)$, where $\alpha = (\alpha_0, \alpha_1, \alpha_2)$, $\gamma = (\gamma_0, \ldots, \gamma_{13})$, $\delta = (\delta_0, \ldots, \delta_{10})$, and $\lambda = (\lambda_0, \lambda_1)$. Using our estimates of α_0 and α_1 we can answer two important questions regarding the selection of the formateur. First, if the size of one party increases by 1%, by what percentage does its probability of being selected as formateur increase? Providing an answer to this question is rather important. For example, a (possibly) desirable property of a formateur selection rule requires that if the size of a party increases by 1%, its recognition probability also increases by 1%. This implies that a party cannot increase its

TABLE V

MAXIMUM LIKELIHOOD ESTIMATES

Parameter	Estimate	Standard Error
α_0	9.577	0.887
α_1	1.360	0.182
α_2	2.477	0.250
β	0.759	0.023
γ_0	−1.644	0.151
γ_1	5.610	0.440
γ_2	1.120	0.139
γ_3	1.236	0.193
γ_4	2.631	0.211
γ_5	−2.087	0.243
γ_6	−0.168	0.104
γ_7	1.071	0.139
γ_8	0.366	0.203
γ_9	−0.479	0.117
γ_{10}	0.464	0.171
γ_{11}	1.408	0.276
γ_{12}	−2.493	0.354
γ_{13}	−2.015	0.139
δ_0	−0.491	0.552
δ_1	−2.575	0.496
δ_2	−1.879	0.391
δ_3	−0.823	0.659
δ_4	−0.622	0.623
δ_5	−1.822	9.902
δ_6	0.991	0.233
δ_7	1.493	0.626
δ_8	0.733	0.379
δ_9	−0.369	0.841
δ_{10}	1.931	0.564
λ_0	0.962	0.233
λ_1	−0.508	0.259
ρ	35.228	0.002
Log-Likelihood	−2930.94	

chances of forming a government by splitting, and two parties cannot get more joint chances by merging. To answer this question we obtain an estimate of the elasticity of the probability a party is selected as formateur with respect to its size, $\partial \ln p_i / \partial \ln \pi_i = \alpha_0 \pi_i (1 - p_i)$, for each party in our sample, and we then compute the average across all observations. The estimate we obtain for this elasticity is equal to 0.99. The standard error associated with this estimate is equal to 0.08.[28] Hence, the null hypothesis that the elasticity is equal to 1 cannot be rejected at conventional significance levels.[29]

The second question concerning the formateur selection process can be stated as follows. For a given observation, consider the party that was successful in forming the previous government (i.e., the party of the former prime minister, $k_{-1} \in N$) and let $p_{k_{-1}}$ be its probability of being selected as formateur. Holding everything else constant, let $\bar{p}_{k_{-1}}$ be party k_{-1}'s average recognition probability if we remove the incumbency advantage from party k_{-1} and we give it to one of the other parties $\ell \in N$ for all $\ell \neq k_{-1}$. How large is the difference in the two probabilities—i.e., what is $p_{k_{-1}} - \bar{p}_{k_{-1}}$? Answering this question provides a measure of the incumbency premium. The average estimate we obtain for this measure of the incumbency premium is rather large and is equal to 0.32 (the standard error associated with this estimate is equal to 0.05). This means that controlling for size, on average an incumbent party is 32% more likely to be selected as formateur than if it were not the incumbent (and the average incumbency premium is statistically greater than zero at conventional significance levels). An alternative measure of the incumbency premium can be obtained by computing the increase in the recognition probability of a nonincumbent party $\ell \in N$, $\ell \neq k_{-1}$, if we give to that party the incumbency advantage of party k_{-1}. The average estimate of this alternative measure of the incumbency premium we obtain is smaller than the previous measure and is equal to 0.18 (with a standard error of 0.04). This means that controlling for size, on average a nonincumbent party is 18% less likely to be selected as formateur than if it were the incumbent (and this measure of the incumbency premium is also statistically greater than zero at conventional significance levels).

The implications of dynamic models of government behavior in parliamentary democracies are typically very sensitive to the value of the "political discount factor" β (see, e.g., Baron (1998) and Diermeier and Merlo (2000)). For example, in the model of Baron (1998) β directly affects the probability of government dissolution, and in the model of Diermeier and Merlo (2000) it also affects the probability of minority governments. The point estimate we obtain for β is equal to 0.76 with a standard error of 0.02. This implies a relatively high degree of

[28] All the quantities reported here and their associated standard errors are obtained by drawing 5,000 samples of parameter values from the (estimated) asymptotic distribution of the vector of model parameters (based on the estimated variance-covariance matrix), and then computing the mean and standard deviation of the object of interest over all draws.

[29] Throughout the paper, we adopt the convention that a null hypothesis can (cannot) be rejected at conventional levels of statistical significance if the p-value of its test is smaller than (greater than or equal to) 0.05.

patience (or, alternatively, a relatively moderate distaste for bargaining) on the part of the political parties.

To interpret the estimates we obtained for the other parameters of the model, consider for example the following two institutional environments, $Q_1 = (INVEST = 0,\ NEG = 0,\ CCONF = 0,\ FIXEL = 0)$ and $Q_2 = (INVEST = 0,\ NEG = 0, CCONF = 1, FIXEL = 0)$, and let $\overline{T} = 1000$. The estimates reported in Table V imply the following values for the mean of the distribution of (unobservable) cakes evaluated at the mean government size in the sample for each type of government coalition (standard errors are in parentheses):[30]

$$\widehat{E}[y^D|\overline{T} = 1000, Q_1, \pi^D = 0.41] = \underset{(23)}{297}, \tag{25}$$

$$\widehat{E}[y^D|\overline{T} = 1000, Q_1, \pi^D = 0.58] = \underset{(32)}{501}, \tag{26}$$

$$\widehat{E}[y^D|\overline{T} = 1000, Q_1, \pi^D = 0.66] = \underset{(30)}{404}, \tag{27}$$

$$\widehat{E}[y^D|\overline{T} = 1000, Q_2, \pi^D = 0.41] = \underset{(42)}{363}, \tag{28}$$

$$\widehat{E}[y^D|\overline{T} = 1000, Q_2, \pi^D = 0.58] = \underset{(38)}{651}, \tag{29}$$

$$\widehat{E}[y^D|\overline{T} = 1000, Q_2, \pi^D = 0.66] = \underset{(41)}{602}. \tag{30}$$

These estimates indicate that the mean expected government duration for a minimum winning coalition that controls 58% of the parliamentary seats in a political system with a constructive vote of no-confidence, Q_2, is 1.3 times its mean expected government duration in a similar political system without a constructive vote of no-confidence, Q_1. A similar comparison holds for a minority coalition that controls 41% of the parliamentary seats, while this ratio is equal to 1.5 for a surplus coalition that controls 66% of the parliamentary seats. Furthermore, in a political system without a constructive vote of no-confidence, Q_1, the mean expected government duration of a minimum winning coalition of average size is 1.7 times the mean expected government duration of a minority coalition of average size and 1.2 times the mean expected government duration of a surplus coalition of average size (these ratios are equal to 1.8 and 1.1, respectively, in a similar political system with a constructive vote of no-confidence, Q_2).[31]

[30] It follows from the assumption about the distribution of y that

$$E[y^D|\overline{T}, Q, \pi^D] = \frac{\gamma(\overline{T}, Q, \pi^D)}{1+\gamma(\overline{T}, Q, \pi^D)}\bar{y}(\overline{T}, Q).$$

The average sizes of minority, minimum winning, and surplus governments in our sample are equal to 41%, 58%, and 66%, respectively.

[31] Similar comparisons can be computed for all possible combinations of $(\overline{T}, Q, \pi^D)$.

The coalition partners, however, agree to form a government only if its expected duration exceeds a threshold and delay agreement otherwise. This implies that not all potential governments form, and governments that are expected to have shorter duration are less likely to form. To evaluate the extent of the selection on expected government duration, we report the following estimates of the mean expected government duration if an agreement occurs, computed for the same values of $\overline{T}$, Q, and π^D as before (standard errors are in parentheses):[32]

$$\widehat{E}[y^D|y^D \geq y^*(D, \overline{T} = 1000, Q_1, \pi^D = 0.41)] = \underset{(30)}{499}, \tag{31}$$

$$\widehat{E}[y^D|y^D \geq y^*(D, \overline{T} = 1000, Q_1, \pi^D = 0.58)] = \underset{(34)}{582}, \tag{32}$$

$$\widehat{E}[y^D|y^D \geq y^*(D, \overline{T} = 1000, Q_1, \pi^D = 0.66)] = \underset{(33)}{543}, \tag{33}$$

$$\widehat{E}[y^D|y^D \geq y^*(D, \overline{T} = 1000, Q_2, \pi^D = 0.41)] = \underset{(36)}{528}, \tag{34}$$

$$\widehat{E}[y^D|y^D \geq y^*(D, \overline{T} = 1000, Q_2, \pi^D = 0.58)] = \underset{(37)}{658}, \tag{35}$$

$$\widehat{E}[y^D|y^D \geq y^*(D, \overline{T} = 1000, Q_2, \pi^D = 0.66)] = \underset{(37)}{628}. \tag{36}$$

The comparison of the estimates reported in equations (31)–(36) with those in equations (25)–(30) (which are estimates of the mean expected duration regardless of whether an agreement actually occurs), indicates that the selection effect as a consequence of delaying agreement may be substantial, and the extent of the selection depends both on the type of coalitions and their institutional environment. For example, while the unconditional mean expected duration for a minority coalition that controls 41% of the parliamentary seats in a political system without a constructive vote of no-confidence, Q_1, is 40% smaller than its average duration conditional on this coalition actually forming the government, the percentages are 14% and 25% for a minimum winning coalition that controls 58% of parliament and a surplus coalition that controls 66% of parliament, respectively. Also, for all types of coalitions, the extent of the selection induced by delays in the government formation process is smaller in a political system with a constructive vote of no-confidence, Q_2, than in a similar political system without a constructive vote of no-confidence, Q_1, both in absolute and in relative terms.

[32] It follows from the assumption about the distribution of y that

$$E[y^D|y^D \geq y^*(D, \overline{T}, Q, \pi^D)] = \frac{\gamma(\overline{T}, Q, \pi^D)}{1+\gamma(\overline{T}, Q, \pi^D)} \left[\frac{\bar{y}(\overline{T}, Q)^{1+\gamma(\overline{T}, Q, \pi^D)} - y^*(D, \overline{T}, Q, \pi^D)^{1+\gamma(\overline{T}, Q, \pi^D)}}{\bar{y}(\overline{T}, Q)^{\gamma(\overline{T}, Q, \pi^D)} - y^*(D, \overline{T}, Q, \pi^D)^{\gamma(\overline{T}, Q, \pi^D)}} \right].$$

The next step to consider is the choice of a coalition by the formateur party. Again, let $\overline{T} = 1000$ and consider the two institutional environments, Q_1 and Q_2, described above. Suppose there are four parties, $N = \{1, 2, 3, 4\}$, with $\pi = (0.41, 0.34, 0.17, 0.08)$, and party 1 is the formateur.[33] The set of possible coalitions is given by

$$\Delta_1 = \{\{1\}, \{1, 2\}, \{1, 3\}, \{1, 4\}, \{1, 2, 3\}, \{1, 2, 4\}, \{1, 3, 4\}, \{1, 2, 3, 4\}\}$$

and the sizes of these coalitions are $\pi^{\{1\}} = 0.41$, $\pi^{\{1,2\}} = 0.75$, $\pi^{\{1,3\}} = 0.58$, $\pi^{\{1,4\}} = 0.49$, $\pi^{\{1,2,3\}} = 0.92$, $\pi^{\{1,2,4\}} = 0.83$, $\pi^{\{1,3,4\}} = 0.66$, and $\pi^{\{1,2,3,4\}} = 1$, where $\{1\}$ and $\{1, 4\}$ are minority coalitions, $\{1, 2\}$ and $\{1, 3\}$ are minimum winning coalitions, and $\{1, 2, 3\}$, $\{1, 2, 4\}$, $\{1, 3, 4\}$, and $\{1, 2, 3, 4\}$ are surplus coalitions.

Consider for example the single-party minority coalition $\{1\}$, the two-party minimum winning coalition $\{1, 3\}$, and the three-party surplus coalition $\{1, 3, 4\}$. Given our estimates, the expected durations of each of these coalitions if they are selected to form the government are given in equations (31)–(33) if the institutional environment is Q_1 and in equations (34)–(36) if the institutional environment is Q_2. What matters to the formateur party, however, is not the durability of a coalition per se, but the payoff it would receive from selecting a particular coalition to form the government. As discussed in Section 2.1 above, when choosing a government coalition, the formateur faces a trade-off between "control" (i.e., its own share of the cake) and "durability" (i.e., the overall size of the cake). That is, on the one hand, relatively larger coalitions may be associated with longer expected durations and hence relatively larger cakes. On the other hand, because of proto-coalition bargaining, the formateur party would receive a smaller share of the cake by including additional parties in its coalition. Which coalition is chosen in equilibrium depends on the terms of this trade-off.

If the institutional environment is Q_1, the estimates reported in Table V imply the following values for the probabilities that the formateur party 1 would select coalition $\{1\}$, $\{1, 3\}$, or $\{1, 3, 4\}$ (standard errors are in parentheses):[34]

$$\widehat{\Pr}(\{1\}|Q_1) = \underset{(0.07)}{0.36}, \tag{37}$$

$$\widehat{\Pr}(\{1, 3\}|Q_1) = \underset{(0.06)}{0.35}, \tag{38}$$

$$\widehat{\Pr}(\{1, 3, 4\}|Q_1) = \underset{(0.01)}{0.02}. \tag{39}$$

[33] The seat shares in this example are chosen so that there exist a minority coalition of size 0.41, a minimum winning coalition of size 0.58, and a surplus coalition of size 0.66 (which are the three coalitions considered above).

[34] These probabilities are computed using equation (18). Note that the probabilities do not add up to one since we are only considering a subset of the choices available to the formateur.

If, on the other hand, the institutional environment is Q_2, the estimated probabilities are:

$$\widehat{\Pr}(\{1\}|Q_2) = \underset{(0.10)}{0.21}, \tag{40}$$

$$\widehat{\Pr}(\{1,3\}|Q_2) = \underset{(0.08)}{0.54}, \tag{41}$$

$$\widehat{\Pr}(\{1,3,4\}|Q_2) = \underset{(0.01)}{0.04}. \tag{42}$$

These estimates indicate that even though the minority alternative $\{1\}$ is on average less stable than the minimum winning alternative $\{1,3\}$, or the surplus alternative $\{1,3,4\}$, it is nevertheless chosen with positive probability in both institutional environments. Furthermore, while in an environment without a constructive vote of no-confidence, Q_1, the minority alternative $\{1\}$ is as likely to be chosen as the minimum winning alternative $\{1,3\}$, in a similar environment with a constructive vote of no-confidence, Q_2, the minimum winning alternative $\{1,3\}$ dominates. In both environments, the reduction in the share of the cake appropriated by the formateur party 1 by including party 3 in its coalition is the same. However, the increase in the overall size of the cake induced by enlarging the coalition from $\{1\}$ to $\{1,3\}$ is much larger in Q_2 than in Q_1 (as evidenced in equations (31)–(32) and (34)–(35), respectively). Finally, in both institutional environments the surplus alternative $\{1,3,4\}$ is clearly inferior to the minimum winning alternative $\{1,3\}$, since by including an additional party in its coalition, party 4, the formateur party 1 would only reduce its share of the cake without increasing the overall size of the cake (as we can see from equations (32)–(33) and (35)–(36), respectively).[35]

We investigate the quantitative implications of our model more fully in Section 6 below. Before that, we first turn our attention to evaluating how well the model fits the data.

5.1. *Goodness-of-Fit*

To assess the fit of the model we begin by presenting Tables VI–X. In each of these tables, we focus on a different dimension of the data and we compare the predictions of the model to the empirical distribution. For each dimension of the data, one of the criteria we use to assess how well the model fits the data is Pearson's χ^2 test,

$$q\sum_{j=1}^{K}\frac{[f(j)-\hat{f}(j)]^2}{\hat{f}(j)} \sim \chi^2_{K-1},$$

[35] Still, the surplus alternative $\{1,3,4\}$ may be chosen if the formateur party has a very strong preference for this coalition.

TABLE VI

DENSITY FUNCTIONS OF FORMATEUR SIZE AND GOODNESS-OF-FIT TEST

Interval	Data	Model
0%–10%	0.016	0.044
10%–20%	0.086	0.060
20%–30%	0.188	0.162
30%–40%	0.259	0.280
40%–50%	0.365	0.367
50%+	0.086	0.086
χ^2 test	9.061	
$\Pr(\chi^2(5) \geq 9.061)$	0.107	

TABLE VII

DENSITY FUNCTIONS OF NEGOTIATION DURATION AND GOODNESS-OF-FIT TEST

Attempt	Data	Model
1	0.616	0.608
2	0.188	0.208
3	0.102	0.089
4	0.059	0.043
5	0.024	0.022
6	0.004	0.012
7	0.008	0.007
8+	0.000	0.012
Mean Number of Attempts	1.729	1.784
χ^2 test	3.984	
$\Pr(\chi^2(7) \geq 3.984)$	0.782	

where $f(\cdot)$ denotes the empirical density function, or histogram, of a given (endogenous) variable, $\hat{f}(\cdot)$ denotes the maximum likelihood estimate of the density function of that variable, q is the number of observations, and K is the number of bins of the histogram.[36]

In Table VI, we compare the density of the size of the formateur party predicted by the model to the empirical density. As we can see from this table, the χ^2 goodness-of-fit test does not reject the model at conventional significance levels. In Table VII, we compare the density of negotiation duration predicted by the model to the empirical density. The χ^2 goodness-of-fit test reported in Table VII does not reject the model at conventional significance levels, and the predicted mean number of attempts is almost identical to the one observed in

[36] Note that the number of degrees of freedom is an upper bound because we do not take into account that the parameters in the model are estimated.

TABLE VIII

DENSITY FUNCTIONS OF GOVERNMENT DURATION AND GOODNESS-OF-FIT TEST

Interval	Data	Model
0–6 mo	0.192	0.222
6 mo–1 yr	0.184	0.141
1yr–1.5 yr	0.145	0.119
1.5 yr–2 yr	0.137	0.118
2 yr–2.5 yr	0.094	0.105
2.5 yr–3 yr	0.071	0.103
3 yr–3.5 yr	0.055	0.074
3.5 yr–4 yr	0.098	0.098
4 yr–4.5 yr	0.024	0.017
4.5 yr–5 yr	0.000	0.000
Mean Government Duration (Days)	603	622
χ^2 test	11.716	
$\Pr(\chi^2(9) \geq 11.716)$	0.230	

TABLE IX

DENSITY FUNCTIONS OF GOVERNMENT SIZE AND GOODNESS-OF-FIT TEST

Interval	Data	Model
0%–10%	0.000	0.002
10%–20%	0.016	0.013
20%–30%	0.031	0.027
30%–40%	0.102	0.095
40%–50%	0.263	0.263
50%–60%	0.345	0.355
60%–70%	0.145	0.150
70%–80%	0.055	0.052
80%–90%	0.039	0.029
90%–100%	0.004	0.013
Mean Government Coalition Size (%)	53	53
χ^2 test	3.546	
$\Pr(\chi^2(9) \geq 3.546)$	0.939	

TABLE X

DENSITY FUNCTIONS OF GOVERNMENT TYPE AND GOODNESS-OF-FIT TEST

Government Type	Data	Model
Minority	40%	40%
Minimum Winning	36%	35%
Surplus	24%	25%
χ^2 test	0.268	
$\Pr(\chi^2(2) \geq 0.268)$	0.875	

the data. Table VIII reports evidence on the fit of the model to the government duration data, by comparing the density of government duration predicted by the model to the empirical density. The model is capable of reproducing the shape of the empirical distribution and the average government duration predicted by the model is remarkably close to the observed average. Moreover, the χ^2 goodness-of-fit test cannot reject the model at conventional significance levels. In Table IX, we compare the density of government size predicted by the model to the empirical density. As we can see from this table, the model is capable of reproducing the shape of the distribution and correctly predicts its mean. Furthermore, the χ^2 goodness-of-fit test does not reject the model at conventional significance levels. Finally, Table X reports evidence on the fit of the model to the distribution of government types. As we can see from this table, the model tracks almost perfectly the fraction of minority, minimum winning, and surplus governments in the data and, as it is the case for all other aspects of the data, the χ^2 goodness-of-fit test cannot reject the model at conventional significance levels. We conclude that the model performs remarkably well in reproducing all aggregate features of the data.

Next, we turn our attention to assessing how well the model reproduces similarities and differences across countries in coalition formation and government stability. In Figures 7–9, we plot the actual and model predicted average number of attempts, average government duration, and average government size, respectively, for each of the nine countries in our data set. Furthermore, in

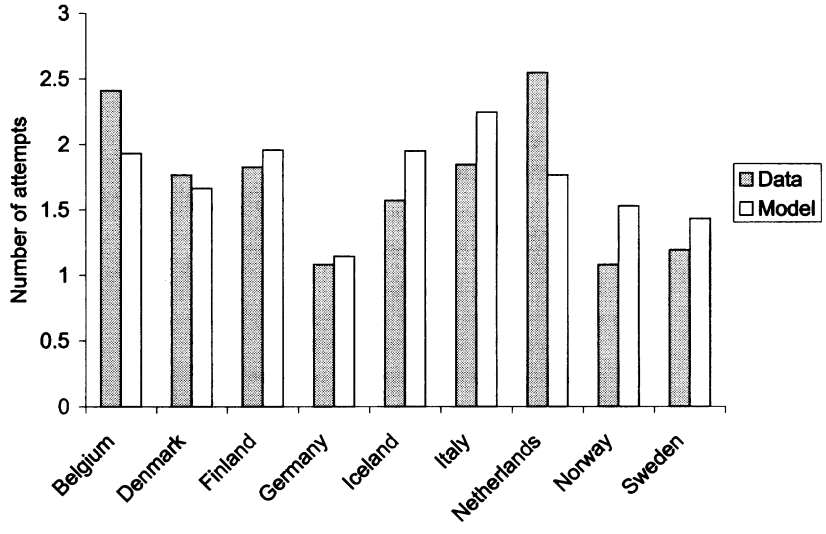

FIGURE 7.—Mean number of attempts.

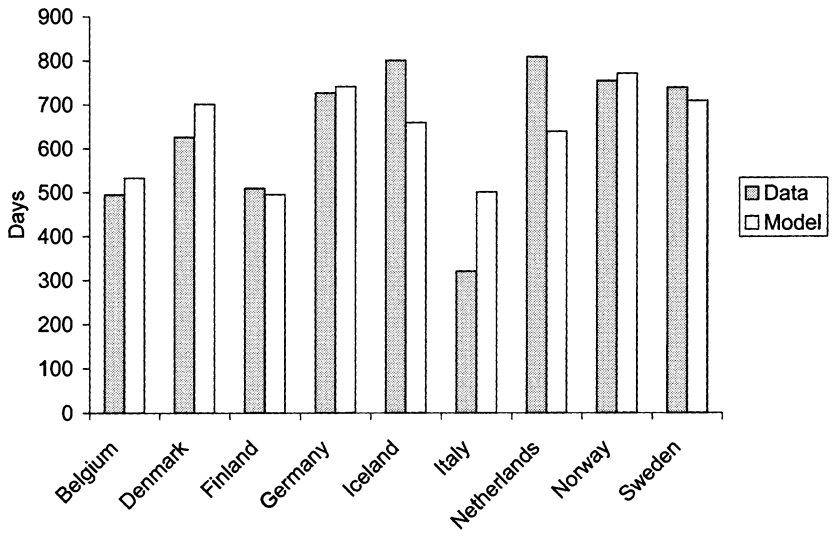

FIGURE 8.—Mean government duration.

Figures 10–12, we plot the actual and predicted fraction of minority, minimum winning, and surplus governments, respectively, in each country. As we can see from these figures, by and large, the model is capable of reproducing the cross-country patterns observed in the data. Most of the country-level implications of

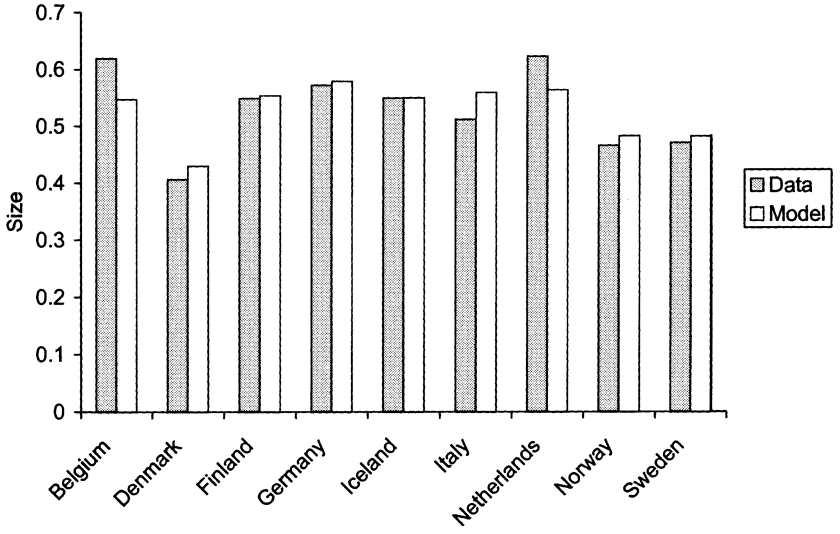

FIGURE 9.—Mean government size.

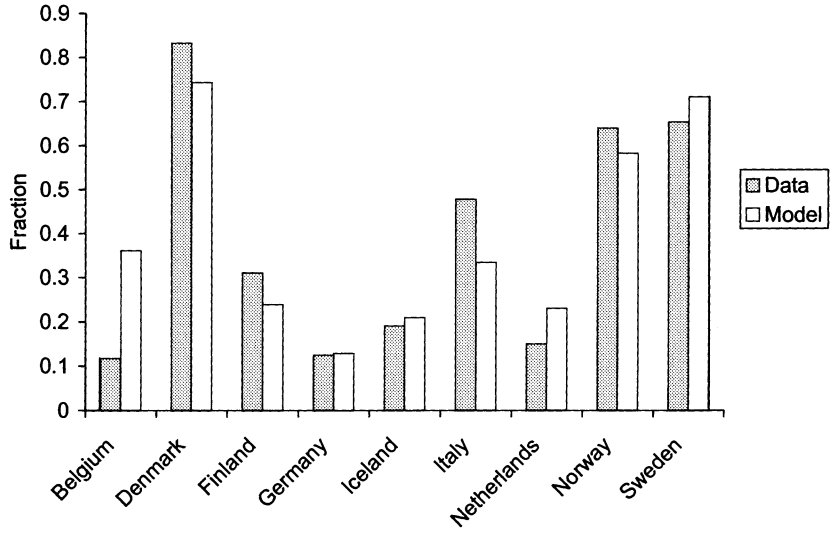

FIGURE 10.—Fraction of minority governments.

the model are not statistically different from their empirical counterparts, and even when there are differences they tend to be small. Overall, we conclude that the predictions of the model track the cross-country features of the data fairly closely.

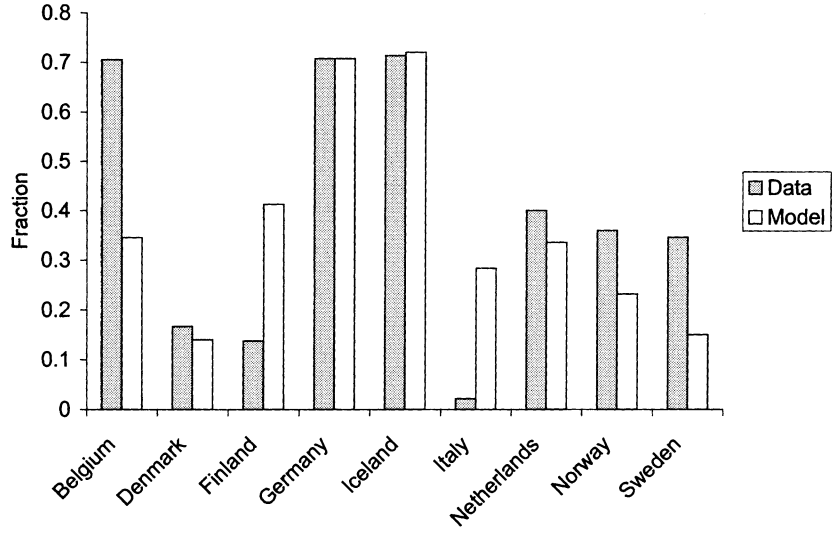

FIGURE 11.—Fraction of minimum winning governments.

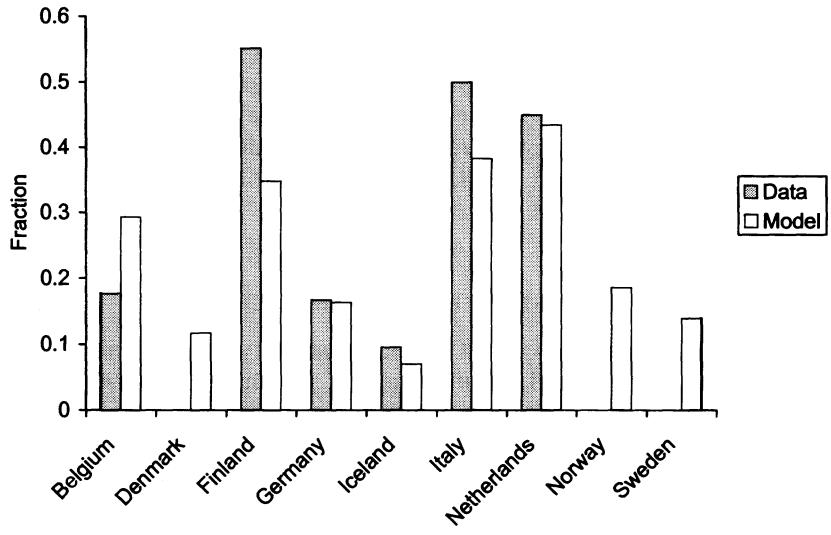

FIGURE 12.—Fraction of surplus governments.

Last, we evaluate how well the model predicts important features of behavior out of sample. The procedure we follow to address this issue consists of leaving one country out of the sample for estimation and then asking how well the resulting model characterizes the behavior of this country. We perform this procedure three times, each time excluding a different country from the sample we use for estimating the model. These countries are Belgium, Finland, and Norway, which differ from each other with respect to their institutional environment. In Table XI, we report the model predicted average number of attempts, average government duration, and average government size for each of the

TABLE XI

OUT-OF-SAMPLE PREDICTIONS[a]

Country	Mean Number of Attempts	Mean Government Duration (Days)	Mean Government Size (%)
Belgium	1.6	471	52
	(0.12)	(47)	(1)
Finland	2.2	476	56
	(0.09)	(32)	(1)
Norway	1.7	758	49
	(0.17)	(27)	(1)

[a]Standard errors are in parentheses.

three countries (with standard errors).[37] When comparing the out-of-sample predictions in Table XI with their empirical counterparts in Table III, we see that the model correctly predicts the size and duration of governments in each of the three countries (with the exception of government size in Belgium). Also, while the average number of attempts predicted by the model is statistically different from its empirical counterpart in each of the three countries, these differences are quantitatively unimportant.

6. CONSTITUTIONAL EXPERIMENTS

Empirical studies have shown that political instability has a detrimental effect on economic performance and growth (see, e.g., Alesina et al. (1996) and Barro (1991)). For a democracy, political instability means short-lived governments and long-lasting negotiations. It is therefore important to try to evaluate the effect of specific institutional features of a democracy on its political stability. Our approach offers a systematic way of addressing these quantitative issues in the context of an equilibrium framework. We focus here on the four aspects of parliamentary democracies discussed above (i.e., the investiture vote, negative parliamentarism, the constructive vote of no-confidence, and a fixed interelection period) and we use our estimated model to quantify the effects of each of these institutional features on the formation and dissolution of coalition governments.

To conduct our constitutional experiments we consider an artificial political system with five parties, $N = \{1, \ldots, 5\}$, and $\overline{T} = 1000$, and we simulate the outcomes of 5,000 elections by randomly drawing vectors of the parties' seat shares in parliament from a uniform distribution on $\Pi = \{(\pi_1, \pi_2, \pi_3, \pi_4, \pi_5) : \pi_i \in (0, 0.5), \sum_{i \in N} \pi_i = 1\}$.[38] For each possible configuration of the institutional environment, $Q = (INVEST, NEG, CCONF, FIXEL)$, we use the estimated model to compute the predicted distributions of negotiation duration, government duration, government size, and government type for each electoral outcome, and we then average across all draws.[39]

[37] Recall that for each country, these statistics are computed using the estimates of the model parameters obtained from a sample that excludes this country. To economize on space, these estimates are not reported here but are available from the authors upon request.

[38] Note that the institutional features we consider here may affect the electoral outcomes. Since in our model elections are exogenous, our analysis abstracts from such (possible) general equilibrium effects, and in our simulations we assume that all outcomes are equally likely. Also note, however, that in order to check the robustness of our results we generated another set of experiments where we simulated the outcomes of 5,000 elections by randomly drawing vectors of the parties' shares from their empirical distribution. The results we obtained under the two alternative experimental designs are virtually identical. We conclude that our results are not sensitive to the details of the process that generates the distribution of seats in parliament.

[39] As a further check on the robustness of our results we generated two additional sets of experiments by changing the number of parties to three and seven, respectively. The results we obtained under these two alternative specifications are virtually identical to the ones reported here. We conclude that our results are not sensitive to the number of parties represented in parliament.

Tables XII and XIII present the results of our experiments.[40] In Table XII we report the mean number of attempts, the mean government duration, and the mean government size implied by the model for ten political systems that differ with respect to their institutional environment, Q. For each of these political systems, Table XIII presents the model predicted distribution of minority, minimum winning, and surplus governments.

As we can see from Table XII, the most stable political system (i.e., the political system with the shortest government formation duration and the longest government duration) has a positive form of parliamentarism with the constructive vote of no-confidence, no investiture vote, and a fixed interelection period. At the opposite end of the spectrum, the least stable political system (i.e., the political system with the longest government formation duration and the shortest government duration) has a positive form of parliamentarism with the investiture vote, no constructive vote of no-confidence, and no fixed interelection period.

The mean government duration in the most stable political system is 1.6 times the mean government duration in the least stable political system. The mean number of attempts in the most stable political system is almost half of the mean number of attempts in the least stable political system. Adding the investiture vote to the most stable political system results in an 8% increase in the mean number of attempts and a 4% decrease in the mean government duration. Simultaneously removing the constructive vote of no-confidence and the fixed interelection period results in a 42% increase in the mean number of attempts and a 30% decrease in the mean government duration. Removing the investiture vote from the least stable political system results in a 19% decrease in the mean number of attempts and a 25% increase in the mean government duration. Adding the constructive vote of no-confidence results in a 38% decrease in the mean number of attempts and a 16% increase in the mean government duration. Simultaneously implementing both changes results in a 43% decrease in the mean number of attempts and a 43% increase in the mean government duration.[41]

The next set of observations concerns the propensity of different political systems to generate government coalitions of different types. Even though minority governments on average last less than majority governments, as we can see from Table XIII the ranking of political institutions with respect to the relative frequency of minority governments does not mirror their ranking based on stability. In fact, while the most stable political institution also has the smallest fraction of minority governments, the least stable one has only the third largest fraction of minority governments. In general, the presence of the constructive vote of

[40] Given that the set of all possible configurations of the institutional environment Q is very large, in what follows we restrict attention to a subset. In particular, since in its strictest interpretation negative parliamentarism is inconsistent with either the investiture vote or the constructive vote of no-confidence, we omit configurations where these features coexist.

[41] This experiment mimics the constitutional reform implemented in Belgium in 1995, whose explicit intent was to increase the stability of Belgian governments.

TABLE XII

CONSTITUTIONAL EXPERIMENTS—GOVERNMENT FORMATION AND DURATION[a]

Q	Mean Number of Attempts	Mean Government Duration (Days)	Mean Government Size (%)
INVEST = 0 NEG = 0 CCONF = 0 FIXEL = 0	1.7 (0.07)	549 (32)	54 (1)
INVEST = 0 NEG = 0 CCONF = 0 FIXEL = 1	1.8 (0.12)	673 (17)	55 (2)
INVEST = 1 NEG = 0 CCONF = 0 FIXEL = 0	2.1 (0.09)	438 (33)	53 (1)
INVEST = 1 NEG = 0 CCONF = 0 FIXEL = 1	2.1 (0.15)	632 (19)	53 (2)
INVEST = 0 NEG = 0 CCONF = 1 FIXEL = 0	1.2 (0.07)	628 (38)	56 (2)
INVEST = 0 NEG = 0 CCONF = 1 FIXEL = 1	1.2 (0.08)	783 (22)	57 (2)
INVEST = 1 NEG = 0 CCONF = 1 FIXEL = 0	1.3 (0.10)	510 (41)	57 (2)
INVEST = 1 NEG = 0 CCONF = 1 FIXEL = 1	1.3 (0.13)	751 (28)	57 (2)
INVEST = 0 NEG = 1 CCONF = 0 FIXEL = 0	1.5 (0.05)	573 (35)	42 (1)
INVEST = 0 NEG = 1 CCONF = 0 FIXEL = 1	1.6 (0.07)	695 (10)	42 (1)

[a]Standard errors are in parentheses.

TABLE XIII

CONSTITUTIONAL EXPERIMENTS—DISTRIBUTION OF GOVERNMENT TYPES[a]

Q	% Minority Governments	% Minimum Winning Governments	% Surplus Governments
INVEST = 0 NEG = 0 CCONF = 0 FIXEL = 0	37 (6)	51 (5)	12 (2)
INVEST = 0 NEG = 0 CCONF = 0 FIXEL = 1	31 (8)	60 (8)	9 (2)
INVEST = 1 NEG = 0 CCONF = 0 FIXEL = 0	46 (5)	40 (4)	14 (2)
INVEST = 1 NEG = 0 CCONF = 0 FIXEL = 1	45 (8)	47 (7)	8 (2)
INVEST = 0 NEG = 0 CCONF = 1 FIXEL = 0	20 (9)	64 (7)	16 (3)
INVEST = 0 NEG = 0 CCONF = 1 FIXEL = 1	12 (8)	76 (7)	12 (2)
INVEST = 1 NEG = 0 CCONF = 1 FIXEL = 0	23 (10)	58 (8)	19 (4)
INVEST = 1 NEG = 0 CCONF = 1 FIXEL = 1	15 (12)	74 (11)	11 (2)
INVEST = 0 NEG = 1 CCONF = 0 FIXEL = 0	85 (5)	11 (4)	4 (1)
INVEST = 0 NEG = 1 CCONF = 0 FIXEL = 1	88 (4)	10 (3)	2 (0.7)

[a] Standard errors are in parentheses.

TABLE XIV

CONSTITUTIONAL EXPERIMENTS—$\overline{T} = 2000$[a]

Q	Mean Number of Attempts	Mean Government Duration (Days)	Mean Government Size (%)
INVEST = 0 NEG = 0 CCONF = 0 FIXEL = 0	2.2 (0.16)	990 (62)	57 (0.8)
INVEST = 0 NEG = 0 CCONF = 0 FIXEL = 1	2.7 (0.40)	1150 (72)	58 (0.9)
INVEST = 1 NEG = 0 CCONF = 0 FIXEL = 0	2.8 (0.20)	760 (62)	55 (1)
INVEST = 1 NEG = 0 CCONF = 0 FIXEL = 1	3.3 (0.46)	1048 (76)	56 (1)
INVEST = 0 NEG = 0 CCONF = 1 FIXEL = 0	1.3 (0.11)	1192 (72)	58 (0.5)
INVEST = 0 NEG = 0 CCONF = 1 FIXEL = 1	1.5 (0.24)	1418 (74)	58 (0.6)
INVEST = 1 NEG = 0 CCONF = 1 FIXEL = 0	1.5 (0.18)	952 (80)	59 (0.9)
INVEST = 1 NEG = 0 CCONF = 1 FIXEL = 1	1.8 (0.32)	1338 (80)	59 (0.8)
INVEST = 0 NEG = 1 CCONF = 0 FIXEL = 0	2.1 (0.10)	1022 (62)	45 (3)
INVEST = 0 NEG = 1 CCONF = 0 FIXEL = 1	2.4 (0.27)	1210 (54)	48 (2)

[a]Standard errors are in parentheses.

TABLE XV

CONSTITUTIONAL EXPERIMENTS—LARGEST PARTY IS THE FORMATEUR[a]

Q	Mean Number of Attempts	Mean Government Duration (Days)	Mean Government Size (%)
INVEST = 0 NEG = 0 CCONF = 0 FIXEL = 0	1.6 (0.07)	554 (32)	54 (1)
INVEST = 0 NEG = 0 CCONF = 0 FIXEL = 1	1.7 (0.12)	679 (17)	55 (2)
INVEST = 1 NEG = 0 CCONF = 0 FIXEL = 0	1.9 (0.08)	442 (35)	54 (1)
INVEST = 1 NEG = 0 CCONF = 0 FIXEL = 1	2.1 (0.15)	636 (18)	53 (2)
INVEST = 0 NEG = 0 CCONF = 1 FIXEL = 0	1.2 (0.06)	632 (38)	57 (2)
INVEST = 0 NEG = 0 CCONF = 1 FIXEL = 1	1.2 (0.07)	789 (22)	57 (2)
INVEST = 1 NEG = 0 CCONF = 1 FIXEL = 0	1.3 (0.09)	516 (41)	57 (2)
INVEST = 1 NEG = 0 CCONF = 1 FIXEL = 1	1.3 (0.11)	759 (26)	57 (2)
INVEST = 0 NEG = 1 CCONF = 0 FIXEL = 0	1.4 (0.05)	582 (36)	45 (1)
INVEST = 0 NEG = 1 CCONF = 0 FIXEL = 1	1.5 (0.07)	708 (11)	44 (0.6)

[a]Standard errors are in parentheses.

no-confidence appears to discourage minority governments from forming, while a negative form of parliamentarism appears to facilitate their formation. Furthermore, a political system with both the investiture vote and the constructive vote of no-confidence appears to be the most conducive to the formation of surplus governments.

Next, we turn our attention to assessing the impact of changing the length of the inter-election period on the formation and duration of governments.[42] In Table XIV, we present the mean number of attempts, the mean government duration, and the mean government size implied by the model for each of the ten political systems considered above when we double the time horizon from $\overline{T} = 1000$ to $\overline{T} = 2000$. Several observations emerge from the comparison of Tables XII and XIV. First, while doubling the time between elections increases average government duration in all political systems, in no political system does this average double. In fact, the increase in average government duration is not uniform across political systems and it ranges from 66% to 90%. Moreover, increasing the length of time between elections also increases the average number of attempts and the average government size in all institutional environments. These effects are also not uniform across political systems.

Last, we evaluate the effects of changing the formateur selection process. In Table XV, we present the mean number of attempts, the mean government duration, and the mean government size implied by the model for each of the ten political systems considered above when we impose that the largest party is always selected as formateur.[43] As we can see from comparing Tables XII and XV, the effects of requiring that the largest party form the government are negligible.[44]

To conclude, note that the framework developed in this paper is very general and can be extended to address a number of issues related to evaluating the performance of democratic institutions. Possible extensions include the study of the role of the head of state and the structure of parliament.

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[42] Over the years, several democracies have amended their constitutions to implement such changes. For example, until 1970, elections in Sweden were held every fourth year. From 1970 through 1994 elections were held every third year. Following the 1994 election, the period between elections has been changed back to four years.

[43] In 1975, Greece adopted a constitution that requires that the party that receives the largest number of votes in an election forms the government.

[44] In fact, we conducted several experiments that involve changes in the formateur selection process. All of these experiments produced virtually no effects on the formation and duration of governments. These findings provide a possible explanation why in almost all democracies the selection of the formateur is not embodied in the constitution or in other official documents.

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Manuscript received January, 2000; final revision received January, 2002.

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