Penn Institute for Economic Research
Department of Economics
University of Pennsylvania
3718 Locust Walk
Philadelphia, PA 19104-6297
pier@econ.upenn.edu
http://www.econ.upenn.edu/pier

PIER Working Paper 02-010

"Bicameralism and Government Formation"

by

Daniel Diermeier, Hülya Eraslan and Antonio Merlo

http://ssrn.com/abstract_id=312149

Bicameralism and Government Formation*

Daniel Diermeier† Hülya Eraslan‡ Antonio Merlo§

May 2002

ABSTRACT

We estimate a bargaining model of government formation in a bicameral parliamentary democracy where the government is responsible to both chambers ("dual responsibility"). We use the estimated structural model to quantify the effects of dual responsibility on the type of government coalitions that form, and their relative stability. Our main findings are that eliminating dual responsibility does not effect government durability, but does have a significant effect on the composition of governments leading to smaller coalitions. These results are due to an equilibrium replacement effect: Removing dual responsibility affects the relative durability of coalitions of different sizes which in turn induces changes in the coalitions that are chosen in equilibrium.

JEL classification: D72, H19, C73.

Keywords: political stability, government formation, government dissolution, bicameralism, comparative constitutional design.

*We thank Torsten Persson, Guido Tabellini, Ken Wolpin, and seminar participants at the University of California-Berkeley, the University of Western Ontario and ITAM for their helpful comments and suggestions. Hugo Nopo provided valuable research assistance.

†MEDS, Kellogg School of Management, Northwestern University. <d-diermeier@kellogg.nwu.edu>

‡Finance Department, Wharton School, University of Pennsylvania. <eraslan@wharton.upenn.edu>

§Department of Economics, University of Pennsylvania and CEPR. <merloa@econ.upenn.edu>

1 Introduction

The study of political constitutions has recently experienced a renaissance in political economy and comparative politics. The main goal of this fast growing area of research is an assessment of the political and economic consequences of constitutional rules, and more generally, political institutions (see, e.g., Baron 1998, Besley and Coate 1997, 1998, Grossman and Helpman 1994, Lizzeri and Persico 2001, Myerson 1993, and Persson, Roland and Tabellini 1997, 2000).[1]

One of the most salient constitutional features is bicameralism, which can be found in approximately one third of all legislatures (Tsebelis and Money 1997). Despite its prominent historical role in constitutional development (e.g. Finer 1997), bicameralism has rarely been the focus of research in either political economy or comparative politics. Consequently, its effects on policy processes and outcomes are not well understood.

Almost all of the existing studies of bicameralism focus on *legislative* bicameralism (that is, a constitutional arrangement where the legislative function is distributed among multiple chambers). Recent examples include Diermeier and Myerson (1999), who show how bicameralism can effect the internal institutional structure of legislatures, and Tsebelis and Money (1997), who explore the consequences of inter-chamber committees on legislative output. Another important aspect of bicameralism, however, is *governmental* bicameralism (that is, a constitutional arrangement where multiple chambers share the right to appoint and remove members of the executive).[2]

Governmental bicameralism is particularly important in parliamentary democracies, where the executive derives its mandate from and is politically responsible to the legislature. In

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

[2] In the United States, for example, ambassadors, heads of agencies, departments and the like are proposed by the president but confirmed by the Senate. Note that, it may be conceptually useful to treat the president as a one-person chamber (Diermeier and Myerson 1999).

these political systems, governmental bicameralism is present whenever the governing coalition has to maintain the confidence of both chambers of parliament to stay in power. We refer to this constitutional feature as "dual responsibility."

West European countries are predominantly parliamentary democracies. However, they differ substantially with respect to the constitutional requirements that prescribe how their governments form and terminate (Lijphart 1984, Müller and Strom 2000).[3] In particular, Italy, Belgium (until 1995), and Sweden (until 1970) are the only three countries with dual responsibility.[4] While dual responsibility is still present in the Italian constitution, in 1970 Sweden became a unicameral parliamentary system and in 1995 Belgium implemented a constitutional reform that eliminated the government's responsibility to its upper chamber.

In spite of the fact that dual responsibility has played a central role in constitutional reforms, there is little empirical or theoretical work that has investigated the consequences of dual responsibility on the composition and the duration of coalition governments. The few studies that investigated the link between bicameralism and coalition governments have focused primarily on legislative bicameralism (Druckman and Thies 2001, Lijphart 1984, Sjölin 1993, Tsebelis 2000). The two main theoretical conclusions that emerge from these studies are that, *ceteris paribus*, bicameralism decreases government duration (Tsebelis 2000) and increases the size of government coalitions (Lijphart 1984, Sjölin 1993). The first conclusion follows from the argument that when the agreement of two chambers is required to change the *status quo* (that is, there are two "veto players"), the government is relatively more unstable.[5] The second conclusion follows from the argument that, in order to pass legislation

[3] The Inter-Parliamentary Union's archives at http://www.ipu.org provides details on many constitutional requirements.

[4] In the case of bicameral parliaments without dual responsibility (like, for example, Germany or the Netherlands), the upper chamber only plays a legislative role, but does not participate either in the appointment or the dismissal of the executive.

[5] Tsebelis' (2000) argument is based on empirical evidence that second chambers can make a difference in legislative outcomes even if the party composition of the two chambers is identical (Tsebelis and Money

and hence implement policies, government coalitions need the support of a majority in both chambers of parliament.[6] In their empirical study of government formation and duration in West European bicameral parliamentary democracies, Druckman and Thies (2001) find that governments that control a majority of seats in both chambers last substantially longer than those who lack majority status in one of the chambers, but they find little evidence that governments add parties that generate "oversized" coalitions in the lower chamber in order to ensure a majority in the upper chamber.[7]

In this paper, we extend the structural approach we develop in Diermeier, Eraslan, and Merlo (2001), henceforth DEM (2001), to investigate the effect of dual responsibility on the type of government coalitions that form and their relative stability. Our approach consists of specifying a bargaining model of government formation in a bicameral parliamentary democracy with dual responsibility, estimating the model's parameters, assessing the ability of the model to account for key features of the data, and then using the estimated structural model to conduct the (counterfactual) constitutional experiment of removing dual responsibility. Specifically, we estimate our structural model using data on Belgian governments over the period 1945-1995. We then use the estimated model to assess the consequences of the Belgian constitutional reform that eliminated dual responsibility in 1995 and provide an equilibrium

1997). He argues that governments in bicameral systems are less like to adapt quickly to exogenous shocks and are thus more likely to fall.

[6]Lijphart's (1984) argument, however, only applies to cases where the two chambers are elected by different constituencies. Italy, for example would be excluded because even though both Italian chambers share all legislative and electoral powers, the representatives are elected from the same constituencies and thus, according to Lijphart, are expected to represent the same interests. Germany, on the other hand, would qualify because even though the veto-powers of Germany's upper house are limited it represents state rather than federal or district-specific constituencies.

[7]Note that Druckman and Thies (2001) do not estimate the effect of bicameralism on government formation and duration. Rather, they are mainly interested in assessing how majority status in the upper chamber of a bicameral parliament affects government duration.

interpretation of our findings within the context of our bargaining model. We also compare the results of our counterfactual experiment with the results of the constitutional reform conducted in Sweden. Since Sweden eliminated dual responsibility (and in fact eliminated its upper chamber altogether) in 1970, a simple comparison of the data before and after the constitutional reform can shed some light on the importance of the equilibrium effects identified by our analysis.[8]

The results of our analysis can be summarized as follows. First, our analysis predicts that abolishing dual responsibility would have virtually no effect on the average duration of governments, while at the same time producing a sizeable impact on their composition. According to our analysis, eliminating government responsibility to the upper chamber would significantly reduce the occurrence of surplus governments and increase the occurrence of *minority* governments. Second, the effects predicted by the model line up with the observations following the 1970 Swedish constitutional reform, where the average duration of governments remained essentially unchanged but the fraction of minority governments doubled.

An important feature of our model is that the size and type (i.e., minority, minimum winning, or surplus) of the government coalition as well as government duration are determined in equilibrium. The following two equilibrium effects play a key role to provide an intuition for our findings. First, there is a trade-off between the size of a coalition and the share of the surplus each coalition member receives. This trade-off determines the equilibrium choice of a coalition and government duration given the composition of parliament in the presence of dual responsibility. Second, there is an equilibrium replacement effect, such that in equilibrium smaller coalitions "replace" larger coalitions. If dual responsibility is removed, the terms of the trade-off change in a way that makes minority coalitions relatively more attractive while leaving government duration the same. In addition to characterizing

[8] Note that we cannot follow the same procedure for Belgium since there are not enough observations following the 1995 reform.

the equilibrium response of strategic parties to changes in their constitutional environment, our approach also allows us to *quantify* the effects of dual responsibility on the composition of government coalitions and government duration.

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

2 Model

We consider a bargaining model of government formation in a bicameral parliamentary democracy with dual responsibility which extends the theoretical framework we develop in DEM 2001.[9] Let $N = \{1, ..., n\}$ denote the set of parties represented in the parliament and let $\pi^C \in \Pi^C = \{(\pi_1^C, ..., \pi_n^C) : \pi_i^C \in (0,1), \sum_{i \in N} \pi_i^C = 1\}$ denote the vector of the parties' relative shares in parliamentary chamber $C \in \{H, S\}$, where H denotes the "House" (lower chamber) and S denotes the "Senate" (upper chamber).[10]

Each party $i \in N$ has linear von Neumann-Morgenstern preferences over the benefits from holding office $x_i \in I\!R_+$ and the composition of the government coalition $G \subseteq N$,

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

where

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

$\varepsilon_i^G > \eta_i^G$, $\varepsilon_i^G, \eta_i^G \in I\!R$. 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

[9] In DEM 2001, we ignore the issue of bicameralism altogether and restrict attention to the lower chamber of parliament which exists in all parliamentary democracies.

[10] The shares are determined by the outcome of a general election which is not modeled here.

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).[11] 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 $s \in \Sigma$ 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 Σ 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. We refer to the selected party $\Bbbk \in N$ as the *formateur*. Following Laver and Shepsle (1996) and Baron (1991, 1993), we assume that the choice of a formateur is non-partisan and the head of state is non-strategic.[12] In particular, we assume that each party $i \in N$ is selected to be a

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

[12] Note that most constitutions are silent with respect to the rules for selecting a formateur, which are generally reflected in unwritten conventions and norms.

formateur with probability

$$p_i(\pi^H, \pi^S, \Bbbk_{-1}) = \begin{cases} 1 & \text{if } \ \pi_i^H > 0.5 \text{ or } \pi_i^S > 0.5 \text{ and } \pi_j^H \leq 0.5 \ , \forall j \in N \\ \frac{\exp(\alpha_0 \pi_i^H + \alpha_1 I_i)}{\sum_{j \in N} \exp(\alpha_0 \pi_j^H + \alpha_1 I_j)} & \text{if } \ \pi_j^C \leq 0.5 \ , \forall j \in N, \text{ for } C = H, S \\ 0 & \text{if } \ \exists \ j \neq i : \pi_j^C > 0.5, \text{ for } C = H \text{ or } C = S \end{cases} , \tag{3}$$

where $\Bbbk_{-1} \in N$ denotes the party of the former prime minister, and I_i is a dummy variable that takes the value 1 if $\Bbbk_{-1} = i$ 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 either chamber of the parliament (where an absolute majority in the Senate is relevant because of dual responsibility), then it has to be selected as the formateur.[13]

The formateur then chooses a *proto-coalition* $D \in \Delta_{\Bbbk}$, where $\Delta_{\Bbbk}$ denotes the set of subsets of N which contain $\Bbbk$.[14] Intuitively, a proto-coalition is a set of parties that agree to talk to each other about forming a government together. Let $\pi^D \equiv (\sum_{i \in D} \pi_i^H, \sum_{i \in D} \pi_i^S)$ 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, $x^D = (x_i^D)_{i \in D} \in R_+^{|D|}$. 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 depends on institutional factors (which include whether the government has dual responsibility), the relative size of the government coalition, the time horizon to the next election, the state

[13] Note that there are no cases in the data where different parties have absolute majorities in different chambers.

[14] 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.

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. 1989, 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 $[0, \overline{T}]$.[15]

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 office benefits from forming a government in state s. Given proto-coalition D, for any state s, let

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

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 proto-coalition 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 $\Bbbk$ 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

[15] Here, we treat government dissolution as exogenous. For a theoretical model where the decision of dissolving a government is endogenous, see Diermeier and Merlo (2000).

party $i \in D$ is selected to make a government proposal with probability

$$\widetilde{p}_i(\pi^H, \pi^S, D) = \begin{cases} 1 & \text{if } \ \pi_i^H > 0.5 \text{ or } \pi_i^S > 0.5 \text{ and } \pi_j^H \leq 0.5 \ , \forall j \in D \\ \frac{\exp(\alpha_2 \pi_i^H)}{\sum_{j \in D} \exp(\alpha_2 \pi_j^H)} & \text{if } \ \pi_j^C \leq 0.5 \ , \forall j \in N, \text{ for } C = H, S \\ 0 & \text{if } \ \exists \ j \neq i : \pi_j^C > 0.5, \text{ for } C = H \text{ or } C = S \end{cases} , \quad (6)$$

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 $\tau^D = 0, 1, ...$ and a $|D|$–dimensional random vector χ^D which 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

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

For any formateur $\Bbbk \in N$, each potential proto-coalition $D \in \Delta_{\Bbbk}$ is associated with an expected payoff for party $\Bbbk$

$$W_{\Bbbk}(D, \overline{T}, Q, \pi^D) = V_{\Bbbk}(D, \overline{T}, Q, \pi^D) + \varepsilon_{\Bbbk}^D. \quad (8)$$

Hence, party $\Bbbk$ chooses the proto-coalition to solve

$$\max_{D \in \Delta_{\Bbbk}} W_{\Bbbk}(D, \overline{T}, Q, \pi^D). \quad (9)$$

Let $D_{\Bbbk} \in \Delta_{\Bbbk}$ denote the solution to this maximization problem.

2.1 Equilibrium Characterization

The characterization of the equilibrium of this model is very similar to the one in DEM (2001), and it relies on the general results for stochastic bargaining games contained in Merlo and Wilson (1995, 1998). In particular, the unique stationary subgame perfect equilibrium of 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 $D \in \Delta_{\Bbbk}$, if D is chosen as the proto-coalition, then D forms the government.

Third, for any formateur $\Bbbk \in N$ and for any potential proto-coalition $D \in \Delta_{\Bbbk}$, the ex-ante expected equilibrium payoff to party $\Bbbk$ is given by

$$W_{\Bbbk}(D, \overline{T}, Q, \pi^D) = \left(\frac{1 - \beta(1 - \widetilde{p}_{\Bbbk}(\pi^H, \pi^S, D))}{\beta} \right) y^*(D, \overline{T}, Q, \pi^D) + \varepsilon^D_{\Bbbk}. \tag{11}$$

Hence, we obtain that for any formateur $\Bbbk \in N$, the equilibrium proto-coalition choice $D_{\Bbbk} \in \Delta_{\Bbbk}$ is given by

$$D_{\Bbbk} = \arg\max_{D\in\Delta_{\Bbbk}} \left(\frac{1-\beta(1-\widetilde{p}_{\Bbbk}(\pi^H,\pi^S,D))}{\beta}\right) y^*(D,\overline{T},Q,\pi^D) + \varepsilon_{\Bbbk}^D, \tag{12}$$

and $D_{\Bbbk}$ forms the government (that is, $G = D_{\Bbbk}$).

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" $\widetilde{p}_{\Bbbk}(\cdot)$, and the formateur's tastes for its coalition partners $\varepsilon_{\Bbbk}^D$.

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, $N = \{1,2,3\}$ with $\pi^H = (1/5, 1/5, 3/5)$ and $\pi^S = (1/5, 3/5, 1/5)$, 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 formateur's proposal, the probability that party 1 is selected to make the next proposal is given by $\widetilde{p}_1 = 1/|D|$. Let $\varepsilon_1^{\{1\}} = \varepsilon_1^{\{1,2\}} = 1/2$ and $\varepsilon_1^{\{1,3\}} = \varepsilon_1^{\{1,2,3\}} = 0$. Note that coalition $\{1\}$ has minority status in both chambers, coalitions $\{1,2\}$ and $\{1,3\}$ have minority status in one chamber but are minimum winning majority coalitions in the other chamber, and coalition $\{1,2,3\}$ is a surplus majority coalition in both chambers.

The time horizon to the next election is five periods, $\overline{T} = 5$. There are two possible states of the world, $\Sigma = \{b, g\}$. Each state is realized with equal probability, $\Pr(\sigma = b) = \Pr(\sigma = g) = 1/2$. Consider an institutional environment with dual responsibility and suppose that if $s = b$, then governments that have minority status in both chambers are expected to last one period, governments that have minority status in one chamber but majority status in the other chamber are expected to last two periods, and governments that have majority status in both chambers are expected to last three periods: that is, $y^{\{1\}}(b) = 1$ and $y^{\{1,2\}}(b) = y^{\{1,3\}}(b) = 2$ and $y^{\{1,2,3\}}(b) = 3$. If, on the other hand, $s = g$, then each government's expected duration is increased by one period: that is, $y^{\{1\}}(g) = 2$, $y^{\{1,2\}}(g) = y^{\{1,3\}}(g) = 3$, and $y^{\{1,2,3\}}(g) = 4$. This specification is intended to capture an environment where both a government's majority status and the state of the world affect the expected stability of coalition governments.[16]

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 $y^*(\{1\}) = 3\beta/2 \leq y^{\{1\}}(b)$, which implies that delays never occur. If, on the other hand, $\beta > 2/3$, then $y^*(\{1\}) = 2\beta/(2-\beta) > y^{\{1\}}(b)$, which implies that delays occur when $s = b$. Hence, using equation (11) above, the equilibrium payoff to party 1 from choosing proto-coalition $\{1\}$ is equal to

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

Next, consider the cases where $D = \{1,2\}$ or $D = \{1,3\}$. It is easy to verify that if $\beta \leq 4/5$, then $y^*(\{1,2\}) = y^*(\{1,3\}) = 5\beta/2 \leq y^{\{1,2\}}(b) = y^{\{1,3\}}(b)$, which implies that agreement occurs in both states of the world. If, on the other hand, $\beta > 4/5$, then $y^*(\{1,2\}) = y^*(\{1,3\}) = 3\beta/(2-\beta) > y^{\{1,2\}}(b) = y^{\{1,3\}}(b)$, which implies that agreement only occurs when $s = g$. Hence, the equilibrium payoff to party 1 from choosing proto-coalition $\{1,2\}$ is equal to

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

[16] See King et al. (1990), Merlo (1997) and Warwick (1994) for empirical evidence.

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

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

Finally, consider the case where $D = \{1,2,3\}$. It is easy to verify that if $\beta \le 6/7$, then $y^*(\{1,2,3\}) = 7\beta/2 \le y^{\{1,2,3\}}(b)$, which implies that agreement occurs in both states of the world. If, on the other hand, $\beta > 6/7$, then $y^*(\{1,2,3\}) = 4\beta/(2-\beta) > y^{\{1,2,3\}}(b)$, which implies that agreement only occurs when $s = g$. Hence, the equilibrium payoff to party 1 from choosing proto-coalition $\{1,2,3\}$ is equal to

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

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[17]

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

A relatively high degree of impatience would induce the formateur to choose a surplus coalition that would immediately agree to form the government.[18] On 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 coalition that has minority status in one chamber but is a minimum winning majority coalition in the other chamber. 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.[19] Finally, for sufficiently low

[17] Since ties are zero probability events, we are ignoring here the event of a tie between two alternatives.

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

[19] Notice that $\{1,3\}$ is never chosen in equilibrium because its expected duration conditional on the state of the world is identical to the one of $\{1,2\}$, but party 1's preferences induce it to prefer $\{1,2\}$.

degrees of impatience, the formateur would choose a coalition that has minority status in both chambers. This government would continue negotiating until the "good" state of the world is realized. Thus, it would last, on average, 2 periods.

The example illustrates the two equilibrium selection effects captured by our model. First, when $\beta > 2/3$, the least durable minority 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. This is a consequence of efficient proto-coalition bargaining. Second, when $\beta \in (0.46, 0.74)$, although a more durable option is always available (that is, a coalition with majority status in both chambers), the formateur chooses a proto-coalition with a smaller expected duration (and no majority status in one of the two chambers) because that increases its share of office benefits. This is an example of the fundamental trade-off 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) which drives the equilibrium selection of government coalitions subject to institutional constraints. Of course, both effects may work in consort. When β is relatively high (i.e., $\beta \in (0.74, 1)$), because short-lived minority governments are screened out in equilibrium, a minority proto-coalition becomes relatively more attractive compared to proto-coalitions with (at least partial) majority status.

To understand the role played by dual responsibility on the equilibrium selection of government coalitions, consider now a different institutional environment without dual responsibility such that $y^{\{1\}}(b) = y^{\{1,2\}}(b) = 2$, $y^{\{1,3\}}(b) = y^{\{1,2,3\}}(b) = 3$, $y^{\{1\}}(g) = y^{\{1,2\}}(g) = 3$, and $y^{\{1,3\}}(g) = y^{\{1,2,3\}}(g) = 4$, while holding everything else constant. Since the seat shares in the Senate are no longer relevant to determine the majority status of government coalitions, coalitions $\{1\}$ and $\{1, 2\}$ are now both minority coalitions, while coalitions $\{1, 3\}$ and $\{1, 2, 3\}$ are both majority coalitions. Relative to the previous case, it is now "as if" all coalitions have majority status in the Senate. Hence, for example, $\{1, 2, 3\}$ now simply corresponds to a surplus majority coalition. As in the case of dual responsibility, this specification is intended to capture an environment that is consistent with some basic empirical regularities about coalition duration. For example, surplus majority coalitions do not necessarily last longer than minimal winning coalitions.[20] Also, without dual responsibility the expected duration of each possible coalition is likely to be longer.[21]

As above, we begin by analyzing the outcome of proto-coalition bargaining for every possible proto-coalition $D \in \Delta_1$. Consider first the case where $D = \{1\}$ or $D = \{1, 2\}$. It is easy to verify that if $\beta \leq 4/5$, then $y^*(\{1\}) = y^*(\{1, 2\}) = 5\beta/2 \leq y^{\{1\}}(b) = y^{\{1,2\}}(b)$, which implies that delays never occur. If, on the other hand, $\beta > 4/5$, then $y^*(\{1\}) = y^*(\{1, 2\}) = 3\beta/(2 - \beta) > y^{\{1\}}(b) = y^{\{1,2\}}(b)$, which implies that delays occur when $s = b$. Hence, the equilibrium payoff to party 1 from choosing proto-coalition $\{1\}$ is equal to

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

and its payoff from choosing proto-coalition $\{1, 2\}$ is equal to

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

Next, consider the cases where $D = \{1, 3\}$ or $D = \{1, 2, 3\}$. It is easy to verify that if $\beta \leq 6/7$, then $y^*(\{1, 3\}) = y^*(\{1, 2, 3\}) = 7\beta/2 \leq y^{\{1,3\}}(b) = y^{\{1,2,3\}}(b)$, which implies that agreement occurs in both states of the world. If, on the other hand, $\beta > 6/7$, then $y^*(\{1, 3\}) = y^*(\{1, 2, 3\}) = 4\beta/(2 - \beta) > y^{\{1,3\}}(b) = y^{\{1,2,3\}}(b)$, which implies that agreement only occurs when $s = g$. Hence, the equilibrium payoff to party 1 from choosing proto-coalition $\{1, 3\}$ is equal to

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

[20] See, e.g., Merlo (1997) and DEM (2001).

[21] See, e.g., Tsebelis (2000).

and its equilibrium payoff from choosing proto-coalition $\{1,2,3\}$ is equal to

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

The equilibrium payoffs to the formateur party 1 associated with all possible proto-coalitions 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 given by

$$D_1 = \begin{cases} \{1,3\} & \text{if} \quad \beta \in (0, 0.29) \\ \{1\} & \text{if} \quad \beta \in (0.29, 1) \end{cases} .$$

Notice that in this case, the surplus coalition $\{1,2,3\}$ is never an equilibrium proto-coalition choice of the formateur party 1 for any value of β. This follows from the fact that without dual responsibility, adding party 2 to the coalition does not increase expected duration, but (because of proto-coalition bargaining) it decreases the formateur's share of office benefits. Hence, $\{1,2,3\}$ is dominated by $\{1,3\}$. For a similar reason $\{1,2\}$ is never selected, since in the absence of dual responsibility both $\{1,2\}$ and $\{1\}$ are minority coalitions. Note also, that the range of values of β where the minority option $\{1\}$ is chosen in equilibrium is larger. Hence, in this example, removing dual responsibility significantly reduces the occurrence of surplus governments and increases the occurrence of minority governments.

Turning our attention to government duration, note that in the case where $\beta < 0.29$, where a majority government is optimal, there is no proto-coalition "screening". That is, $\{1,3\}$ would be observed to last 3.5 periods on average. For $\beta > 0.8$, minority governments are optimal with proto-coalition screening, resulting in an average duration of 3 periods. For $\beta \in (0.29, 0.8)$, minority governments are also optimal but it is not worthwhile for the formateur to delay government formation, thus resulting in an average duration of 2.5 periods. The effect of dual responsibility on government duration is illustrated in Figure 3. Depending on the parameters of the model, eliminating dual responsibility can either have no effect on government duration (e.g., for $\beta < 0.29$), it can increase government duration (e.g., for $\beta > 0.46$), or it can even decrease government duration (e.g., for $\beta \in (0.29, 0.46)$). This last possibility illustrates the potentially powerful consequences of accounting for equilibrium responses by strategic parties. If $\beta \in (0.29, 0.46)$, the formateur party 1 would choose to be in a minority government rather than in the surplus coalition $\{1, 2, 3\}$ if dual responsibility was abandoned.

The example illustrates the equilibrium replacement effect captured by our model. Above, we described the model's fundamental trade-off 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) which drives the equilibrium selection of government coalitions subject to the institutional constraints. The terms of this trade-off depend crucially on the relative durability of the different options which, in turn, depends on the institutional environment where government formation takes place. Changes in the institutional environment brought about by constitutional reforms, induce changes in the terms of the trade-off which trigger an equilibrium response in the selection of the type of government coalitions that form and their relative stability. When the government is responsible both to the House and the Senate, a vote of no-confidence in either chamber of parliament is sufficient to terminate the government. The equilibrium response to this institutional constraint is to from larger (surplus) coalitions (possibly constituting a majority in both chambers), to achieve the desired level of durability at the cost of a loss of control on the part of the formateur. Removing dual responsibility, while holding everything else the same, removes one source of instability and makes it possible to achieve similar levels of durability by "replacing" larger coalitions with smaller coalitions.

As evidenced in this example, our model is capable of addressing the issues 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 that removing dual responsibility would have on the formation and dissolution of coalition governments we need to estimate our structural model.

3 Data and Estimation

Our sample consists of 34 governments in Belgium over the period 1945–1995. An observation in the sample is defined by the identity of the formateur party, $\Bbbk$, the composition of the proto-coalition, $D_{\Bbbk}$, the duration of the negotiation over the formation of a new government (i.e., the number of attempts), $\tau^{D_{\Bbbk}}$, the sequence of proposers (one for each attempt) if the formateur does not succeed to form the government at the first attempt, $\ell_2, ..., \ell_{\tau^{D_{\Bbbk}}}$, and the duration of the government following that negotiation (i.e., the number of days the government remains in power), $t^{D_{\Bbbk}}$. For each element in the sample we also observe 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^H and π^S, and the party of the former prime minister, $\Bbbk_{-1}$.

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. The list of parties represented in the parliament 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*.[22]

Descriptive statistics of all variables are reported in Table 1, where $MINORITY$ is a dummy variable that takes the value one if the government coalition is a minority coalition in the House (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 in the House (i.e., it controls at least 50% of the parliamentary seats) and

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

zero otherwise, $MINWIN$ is a dummy variable that takes the value one if the government coalition is a minimum winning majority coalition in the House (i.e., removing any of the parties from the coalition would always result in a minority coalition), $SURPLUS$ is a dummy variable that takes the value one if the government coalition is a surplus majority coalition in the House (i.e., it is possible to remove at least one party from the coalition without resulting in a minority coalition) and zero otherwise, and $MAJSENATE$ is a dummy variable that takes the value one if the government coalition is a majority coalition in the Senate and zero otherwise.

In the bargaining model described in Section 2, we specified the cake a generic proto-coalition D bargains over 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 after it is formed: T^D. The source for this uncertainty are political events (such as a scandal) occurring while the government is in power. Thus, T^D is modeled as a random variable.[23]

We (the econometricians), however, do not observe the state of the world s.[24] Hence, from the perspective of the econometrician, the cake $y^D(s, \overline{T}, Q, \pi^D) \equiv E[T^D|s, \overline{T}, Q, \pi^D]$ is

[23] The concept of "critical events" that may lead to government termination has a long tradition in the empirical study of coalitions (e.g. Browne et al. 1984).

[24] 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.

also a random variable.[25] 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 $[0, \overline{y}]$, 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 $\overline{y} < \overline{T}$ is the upper bound on the expectations over government duration and $F_T(\cdot|\cdot)$ satisfies the restriction $E[T^D|y^D; \overline{T}, Q, \pi^D] = y^D$.[26] Thus, from the point of view of the econometrician, $y^*(D, \overline{T}, Q, \pi^D)$ solves

$$\begin{aligned} y^* &= \beta \int \max\{y^D,\ y^*\} dF_y(y^D|\overline{T}, Q, \pi^D) \\ &= \beta \left(E[y^D|\overline{T}, Q, \pi^D] + \int_0^{y^*} (\ y^* - y^D) dF_y(y^D|\overline{T}, Q, \pi^D) \right), \end{aligned} \tag{13}$$

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

$$\begin{aligned} \Pr(\tau) &= \left[\Pr\left(y^D < y^*(D, \overline{T}, Q, \pi^D)\right)\right]^{\tau-1} \Pr\left(y^D \geq y^*(D, \overline{T}, Q, \pi^D)\right) \\ &= \left[F_y(y^*(\cdot)|\overline{T}, Q, \pi^D)\right]^{\tau-1} \left[1 - F_y(y^*(\cdot)|\overline{T}, Q, \pi^D)\right]. \end{aligned} \tag{14}$$

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

$$\begin{aligned} \Pr(t|\tau) &= \Pr(t|y^D \geq y^*(D, \overline{T}, Q, \pi^D)) \\ &= \frac{\int_{y^*(\cdot)}^{\overline{y}} f_T(t|y^D; \overline{T}, Q, \pi^D) dF_y(y^D|\overline{T}, Q, \pi^D)}{1 - F_y(y^*(\cdot)|\overline{T}, Q, \pi^D)}. \end{aligned} \tag{15}$$

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 led to the agreement. Hence, in order to compute this probability, we have to average over all the possible cakes that may have induced the agreement.

[25] 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 above, which makes the estimation of the model feasible.

[26] 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 $(\overline{T}, Q, \pi^D)$.

Let us now consider the decision problem faced by the formateur party $\Bbbk$. For each possible coalition $D \in \Delta_{\Bbbk}$, party $\Bbbk$ 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 (11) and depends on the expected outcome of the bargaining process as well as the formateur's tastes for its coalition partners, $\varepsilon_{\Bbbk}^{D}$. Hence, from the perspective of the formateur party that knows its tastes, the optimal coalition choice described in equation (12) is deterministic. We (the econometricians), however, do not observe the formateur's tastes for its coalition partners, $\varepsilon_{\Bbbk}^{D}$. Hence, as above, from the perspective of the econometrician, $\varepsilon_{\Bbbk}^{D}$ is a random variable. This implies that the expected payoff $W_{\Bbbk}(D, \overline{T}, Q, \pi^{D})$ 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 $\varepsilon_{\Bbbk}^{D}$, $D \in \Delta_{\Bbbk}$, are independently and identically distributed according to a type I extreme value distribution with standard deviation ρ.[27] Thus, from the point of view of the econometrician, the probability that the formateur party $\Bbbk$ chooses a particular proto-coalition $D' \in \Delta_{\Bbbk}$ to form the government is given by

$$\begin{aligned}\Pr(D') &= \Pr\left(W_{\Bbbk}(D', \overline{T}, Q, \pi^{D'}) > W_{\Bbbk}(D, \overline{T}, Q, \pi^{D}),\ \forall D \in \Delta_{\Bbbk}\right) \\ &= \frac{\exp\left(\frac{[1-\beta(1-\widetilde{p}_{\Bbbk}(\pi,D'))]y^{*}(D',\overline{T},Q,\pi^{D'})}{\beta\rho}\right)}{\sum_{D\in\Delta_{\Bbbk}}\exp\left(\frac{[1-\beta(1-\widetilde{p}_{\Bbbk}(\pi,D))]y^{*}(D,\overline{T},Q,\pi^{D})}{\beta\rho}\right)}. \end{aligned} \tag{16}$$

We can now derive the likelihood function which 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 $(\Bbbk, D_{\Bbbk}, \tau^{D_{\Bbbk}}, \ell_2, ..., \ell_{\tau^{D_{\Bbbk}}}, t^{D_{\Bbbk}})$ conditional on the vector of (exogenous) characteristics $Z = (\overline{T}, Q, N, \pi, \Bbbk_{-1})$, 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

[27]For a detailed description of the properties of this family of distributions see, e.g., Johnson and Kotz (1970; vol. 1, pp. 272-295).

be written as

$$\begin{aligned}\Pr(\Bbbk, D_{\Bbbk}, \tau^{D_{\Bbbk}}, \ell_2, ..., \ell_{\tau^{D_{\Bbbk}}}, t^{D_{\Bbbk}}|Z;\theta) &= \Pr(\Bbbk|Z;\theta) \times \\ & \Pr(D_{\Bbbk}|\Bbbk, Z;\theta) \times \\ & \Pr(\tau^{D_{\Bbbk}}|D_{\Bbbk}, \Bbbk, Z;\theta) \times \\ & \Pr(\ell_2, ..., \ell_{\tau^{D_{\Bbbk}}}|\tau^{D_{\Bbbk}}, D_{\Bbbk}, \Bbbk, Z;\theta) \times \\ & \Pr(t^{D_{\Bbbk}}|\tau^{D_{\Bbbk}}, D_{\Bbbk}, \Bbbk, Z;\theta), \end{aligned} \tag{17}$$

where

$$\Pr(\Bbbk|Z;\theta) = p_{\Bbbk}(\pi, \Bbbk_{-1}; \alpha_0, \alpha_1),$$

$$\Pr(D_{\Bbbk}|\Bbbk, Z;\theta) = \frac{\exp\left(\frac{[1-\beta(1-\widetilde{p}_{\Bbbk}(\pi, D_{\Bbbk};\alpha_3))]y^*(D_{\Bbbk}, \overline{T}, Q, \pi^{D_{\Bbbk}})}{\beta\rho}\right)}{\sum_{D\in\Delta_{\Bbbk}} \exp\left(\frac{[1-\beta(1-\widetilde{p}_{\Bbbk}(\pi, D;\alpha_3))]y^*(D, \overline{T}, Q, \pi^{D})}{\beta\rho}\right)},$$

$$\Pr(\tau^{D_{\Bbbk}}|D_{\Bbbk}, \Bbbk, Z;\theta) = \left[F_y(y^*(D_{\Bbbk}, \overline{T}, Q, \pi^{D_{\Bbbk}})|\overline{T}, Q, \pi^{D_{\Bbbk}})\right]^{\tau^{D_{\Bbbk}}-1}\left[1 - F_y(y^*(D_{\Bbbk}, \overline{T}, Q, \pi^{D_{\Bbbk}})|\overline{T}, Q, \pi^{D_{\Bbbk}})\right],$$

$$\Pr(\ell_2, ..., \ell_{\tau^{D_{\Bbbk}}}|\tau^{D_{\Bbbk}}, D_{\Bbbk}, \Bbbk, Z;\theta) = \prod_{j=2}^{\tau^{D_{\Bbbk}}} \widetilde{p}_{\ell_j}(\pi, D_{\Bbbk}; \alpha_2),$$

and

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

The log-likelihood function is obtained by summing the logs of (17) over all the elements in the sample.[28]

The next step consists of choosing flexible parametric functional forms for $F_y(\cdot|\cdot)$ and $F_T(\cdot|\cdot)$. As in DEM (2001), we assume that $F_y(\cdot|\cdot)$ and $F_T(\cdot|\cdot)$ belong to the family of beta

[28]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.

distributions.[29] In particular, we let

$$f_y(y^D|\overline{T},Q,\pi^D) = \gamma(\overline{T},Q,\pi^D)\left[\frac{[y^D]^{\gamma(\overline{T},Q,\pi^D)-1}}{[\overline{y}(\overline{T},Q)]^{\gamma(\overline{T},Q,\pi^D)}}\right], \tag{18}$$

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

$$\begin{aligned}\gamma(\overline{T},Q,\pi^D) \quad = \quad & \exp((\gamma_0+\gamma_1\pi^D)MINORITY + \\ & (\gamma_2+\gamma_3\pi^D)MINWIN + \\ & (\gamma_4+\gamma_5\pi^D)SURPLUS + \\ & \gamma_6 MAJSENATE + \\ & \gamma_7\overline{T}),\end{aligned} \tag{19}$$

and

$$\overline{y}(\overline{T},Q) = \frac{\exp(\lambda)}{1+\exp(\lambda)}\overline{T} \tag{20}$$

Furthermore, we let

$$f_T(t^D|y^D;\overline{T},Q,\pi^D) = \frac{1}{B\left(\frac{\delta(\overline{T},Q,\pi^D)y^D}{\overline{T}-y^D}, \delta(\overline{T},Q,\pi^D)\right)}\left[\frac{[t^D]^{\frac{\delta(\overline{T},Q,\pi^D)y^D}{\overline{T}-y^D}-1}[\overline{T}-t^D]^{\delta(\overline{T},Q,\pi^D)-1}}{[\overline{T}]^{\frac{\delta(\overline{T},Q,\pi^D)y^D}{\overline{T}-y^D}+\delta(\overline{T},Q,\pi^D)-1}}\right], \tag{21}$$

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

$$\delta(\overline{T},Q,\pi^D) = \exp(\delta_0 + \delta_1\overline{T}). \tag{22}$$

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

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

[29] 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.

Several comments are in order. First, our parameterization 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.[30] For example, government coalitions of different sizes may differ in their ability to cope with events even when exposed to similar shocks. Specifically, minority governments may be expected to last less than majority governments. Second, the specification described in equations (18)-(22) above also allows for the possibility that government coalitions of the same size may face different survival prospects depending on the remaining time horizon $\overline{T}$.

4 Results

Table 2 presents the maximum likelihood estimates of the parameters of the model, (α, β, γ, δ, λ, ρ), where $\alpha = (\alpha_0, \alpha_1, \alpha_2)$, $\gamma = (\gamma_0, ..., \gamma_7)$, and $\delta = (\delta_0, \delta_1)$. To assess the fit of the model we present Tables 3 to 7. 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

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

where $f(\cdot)$ denotes the empirical density function, or histogram, of a given (endogenous) variable, $\widehat{f}(\cdot)$ 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.

In Table 3, 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 4, we compare the density of

[30] Notice that, by definition of beta distributions, $\gamma(\cdot)$ and $\delta(\cdot)$ must be strictly positive. This justifies the exponential functions in (19) and (21). Also, 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). For more details on the econometric specification see DEM (2001).

negotiation duration predicted by the model to the empirical density. The χ^2 goodness-of-fit test reported in Table 4 does not reject the model at conventional significance levels, and the predicted mean number of attempts is almost identical to the one observed in the data. Table 5 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 6, 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 7 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. The ability of the model to fit the data is an important step toward building confidence in the quantitative implications of the model.

4.1 Constitutional Experiments

We use our estimated model to evaluate the following counterfactual constitutional experiment. Suppose in 1945 Belgium had eliminated government responsibility to the upper chamber from its constitution. What would have been the effects on the composition and durability of Belgian governments according to our model? To answer this question we use the results of past elections and the estimated model to predict the outcomes of the government formation process in the absence of dual responsibility.[31] In particular, we replace $\pi^S = (0, ..., 0)$ for all elections and we set $MAJSENATE = 1$ for all possible coalitions [32]

The results of our experiment are documented in columns 2 and 3 of Table 8. Here, column 1 summarizes the data relative to Belgian governments, column 2 reports the model's predictions based on the actual Belgian constitution (which, until 1995, prescribed the dual responsibility of the government), and column 3 contains the results of the constitutional experiment predicted by our model. Several interesting findings emerge from Table 8. The model predicts that abolishing dual responsibility would have had virtually no effect on the average duration of Belgian governments, while at the same time producing a sizeable impact on their composition. According to our analysis, eliminating government responsibility to the Senate would significantly reduce the occurrence of surplus governments (from 22% to 6%) and increase the occurrence of minority governments (from 13% to 86%). However, the sizes of the standard errors associated with the point predictions of the model indicate that there is a high degree of uncertainty around the quantitative assessment of the impact of the constitutional reform model.

Before attempting to interpret these results, to provide a term of comparison we now use data from Sweden to evaluate the outcomes of a similar constitutional reform implemented in Sweden in 1970.[33] The results of this reform are reported in Table 9. In this table, column 1

[31] Note that this experiment mimics the actual constitutional reform Belgium implemented in 1995. The reason we conduct this counterfactual experiment instead of forecasting the outcome of the reform is that for the latter, we would also need to forecast future electoral outcomes. Of course, our experiment is equivalent to forecasting the outcome of the constitutional reform under the assumption that past electoral results can be used to predict future elections.

[32] This corresponds to a case of legislative, but not governmental bicameralism: the upper chamber only plays a legislative role, but does not participate either in the appointment or the dismissal of the executive.

[33] Recall that the Swedish reform does not constitute a "natural" experiment of eliminating dual responsibility, because Sweden not only abolished dual responsibility of the government, but eliminated Sweden's upper chamber altogether. Thus the Swedish reform simultaneously abandoned legislative and governmental

summarizes the data relative to the 12 Swedish governments prior to the 1970 reform, while column 2 summarizes the data relative to the 14 Swedish governments after the reform. As we can see from this table, the results of the constitutional reform are similar to the ones predicted by our model for Belgium. In particular, while government duration remained virtually unchanged, the fraction of minority governments more than doubled (from 42% to 86%). Note that Sweden never experienced surplus governments (either before or after the reform).[34]

Our theoretical model provides an equilibrium interpretation of these results. At the heart of our bargaining model there is a fundamental trade-off 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) which drives the equilibrium selection of government coalitions subject to the institutional constraints. The terms of this trade-off depend crucially on the relative durability of the different options which, in turn, depends on the institutional environment where government formation takes place. Changes in the institutional environment brought about by constitutional reforms, induce changes in the terms of the trade-off which trigger an equilibrium response in the selection of the type of government coalitions that form and their relative stability. When the government is responsible both to the House and the Senate, a vote of no-confidence in either chamber of parliament is sufficient to terminate the government. The equilibrium response to this institutional constraint is to form larger (surplus) coalitions (possibly constituting a majority in both chambers), to achieve the desired level of durability at the cost of a loss of control. Removing dual responsibility, while holding everything else the same, removes one source of instability and by making each coalition more durable,

bicameralism.

[34] As explained in DEM (2001), the lack of surplus governments in Sweden (but also in Denmark and Norway) is due to a constitutional feature known as *negative parliamentarism*. This feature is not present in the Belgian constitution.

it allows the formateur to achieve higher payoffs by forming smaller coalitions (*equilibrium replacement effect*). Since smaller coalitions are relatively less durable than larger coalitions, however, the replacement effect compensates the duration-enhancing effect of removing dual responsibility, thus leading to a negligible change in average government duration. The magnitude of these effects, of course, depends on the magnitude of the model's parameters.

5 Conclusion

In this paper, we propose a structural approach to study the effects of "dual responsibility" on the composition and stability of coalition governments in the context of a bargaining model of government formation in a bicameral parliamentary democracy. To quantify the qualitative insights or our theoretical model we estimate the model's parameters using a data set that contains all Belgian coalition governments between 1945 and 1995, the year Belgium abandoned dual responsibility in its constitution. These estimates are then used to conduct a counterfactual experiment of constitutional design where we eliminate dual responsibility. Our results indicate a strong selection effect in the types of governments that form. Without dual responsibility formateurs have a stronger incentive to propose minority governments. Since minority governments are less durable than majority governments, the longer expected coalition duration conditional on having formed in a system where dual responsibility has been removed is offset by the selection of shorter-lived coalition types. Based on our estimates, the net effect of removing dual responsibility on average government duration is negligible.

Our findings cast some doubt on the validity of much of the existing empirical research on government stability (e.g. King et al. 1990, Strom 1990, Warwick 1994). Most studies have adopted a reduced-form approach where coalition specific characteristics (such as the coalition's majority status), constitutional factors (e.g. whether an investiture vote is required for a government to assume power), and the political context of government formation (e.g. the number of formation attempts) are combined in the set of exogenous covariates of a regression equation. As shown in our analysis, however, the government's majority status (and, in general, which coalition forms the government), its formation time, and its expected duration are all endogenous and are simultaneously determined in equilibrium. This suggests that the traditional methodology used by existing studies is problematic and may lead to incorrect inference. We hope to explore the implications of these insights further in future research.

References

Baron, David P. 1991. "A Spatial Bargaining Theory of Government Formation in a Parliamentary System." *American Political Science Review* 85:137-64.

Baron, David P. 1993. "Government Formation and Endogenous Parties." *American Political Science Review* 87:34-47.

Baron, David P. 1998. "Comparative Dynamics of Parliamentary Governments." *American Political Science Review* 92:593-609.

Besley, Timothy and Stephen Coate. 1997. "Analyzing the Case of Government Intervention in a Representative Democracy." mimeo. London School of Economics.

Besley, Timothy and Stephen Coate. 1998. "Centralized versus Decentralized Provision of Local Public Goods: A Political Economy Analysis." mimeo. London School of Economics.

Browne, Eric C., John P. Frendreis, and Dennis W. Gleiber. 1984. "An 'Events' Approach to the Problem of Cabinet Stability." *Comparative Political Studies* 17:167-97

Diermeier, Daniel, Eraslan, Hülya, and Antonio Merlo. 2001. "A Structural Model of Government Formation." mimeo. University of Pennsylvania.

Diermeier, Daniel and Antonio Merlo, 2000. "Government Turnover in Parliamentary Democracies." *Journal of Economic Theory* 94, 46-79.

Diermeier, Daniel and Roger B. Myerson. 1999. "Bicameralism and Its Consequences for the Internal Organization of Legislatures." *American Economic Review* 89:1182-1196.

Druckman, James N., and Michael F. Thies. 2001. "The Importance of Concurrence: The Impact of Bicameralism on Government Formation and Duration." Mimeo. University of Minnesota.

Finer, S.E. 1997. *The History of Government.* Oxford: Oxford University Press.

Grossman, Gene, and Elhanan Helpman. 1994. "Protection for Sale." *American Economic Review* 84:833-850.

Johnson, Norman and Samuel Kotz 1970. *Continuous Univariate Distributions.* 2 vols. Distributions in Statistics. New York: Wiley.

King, Gary, Alt, James, Burns, Nancy, and Michael Laver 1990. "A Unified Model of Cabinet Dissolution in Parliamentary Democracies." *American Journal of Political Science* 34:846-871.

Laver, Michael, and Kenneth A. Shepsle. 1996. *Making and Breaking Governments: Cabinets and Legislatures in Parliamentary Democracies.* Cambridge: Cambridge University Press.

Lijphart, Arend. 1984. *Democracies: Patterns of Majoritarian and Consensus Government in Twenty-one Countries.* New Haven: Yale University Press.

Lizzeri, Alessandro, and Nicola Persico. 2001. "The Provision of Public Goods Under Alternative Electoral Incentives." *American Economic Review* 91:225-239.

Mackie, Thomas and Richard Rose. 1990. *The International Almanac of Electoral History*, 3rd edition. New York: Facts on File.

McFadden, David. 1973. "Conditional Logit Analysis of Qualitative Choice Behavior." in P. Zarembka, ed., *Frontiers in Econometrics.* New York: Academic Press.

Merlo, Antonio 1997. "Bargaining over Governments in a Stochastic Environment." *Journal of Political Economy* 105:101-131.

Merlo, Antonio 1998. "Economic Dynamics and Government Stability in Postwar Italy." *Review of Economics and Statistics* 80:629:637.

Merlo, Antonio and Charles Wilson 1995. "A Stochastic Model of Sequential Bargaining with Complete Information." *Econometrica* 63:371-399.

Merlo, Antonio and Charles Wilson. 1998. "Efficient Delays in a Stochastic Model of Bargaining" *Economic Theory* 11:39-55.

Müller, Wolfgang C. and Kaare Strom (eds.), 2000. *Coalition Governments in Western Europe.* Oxford: Oxford University Press.

Persson, Torsten, Gerard Roland, and Guido Tabellini. 1997. "Separation of Powers and Political Accountability." *Quarterly Journal of Economics* 112:1163-1202

Persson, Torsten, Gerard Roland, and Guido Tabellini. 2000. "Comparative Politics and Public Finance." *Journal of Political Economy* 108:1121-1161.

Persson, Torsten and Guido Tabellini, 2000. *Political Economics: Explaining Economic Policy*. Cambridge: MIT Press.

Rust, John. 1987. "Optimal Replacement of GMC Bus Engines: An Empirical Model of Harold Zurcher." *Econometrica* 55:999-1033.

Sjölin, Mats. 1993. *Coalition Politics and Parliamentary Power*. Sweden: Lund University Press.

Strom, Kaare. 1990. *Minority Government and Majority Rule*. Cambridge: Cambridge University Press.

Tsebelis, George. 2000. "Veto Players and Institutional Analysis." *Governance* 13: 441-74.

Tsebelis, George, and Jeannette Money. 1997. *Bicameralism*. New York: Cambridge University Press.

Warwick, Paul. 1994. *Government Survival in Parliamentary Democracies*. Cambridge: Cambridge University Press.

Figure 1: Formateur's Payoffs with Dual Responsibility

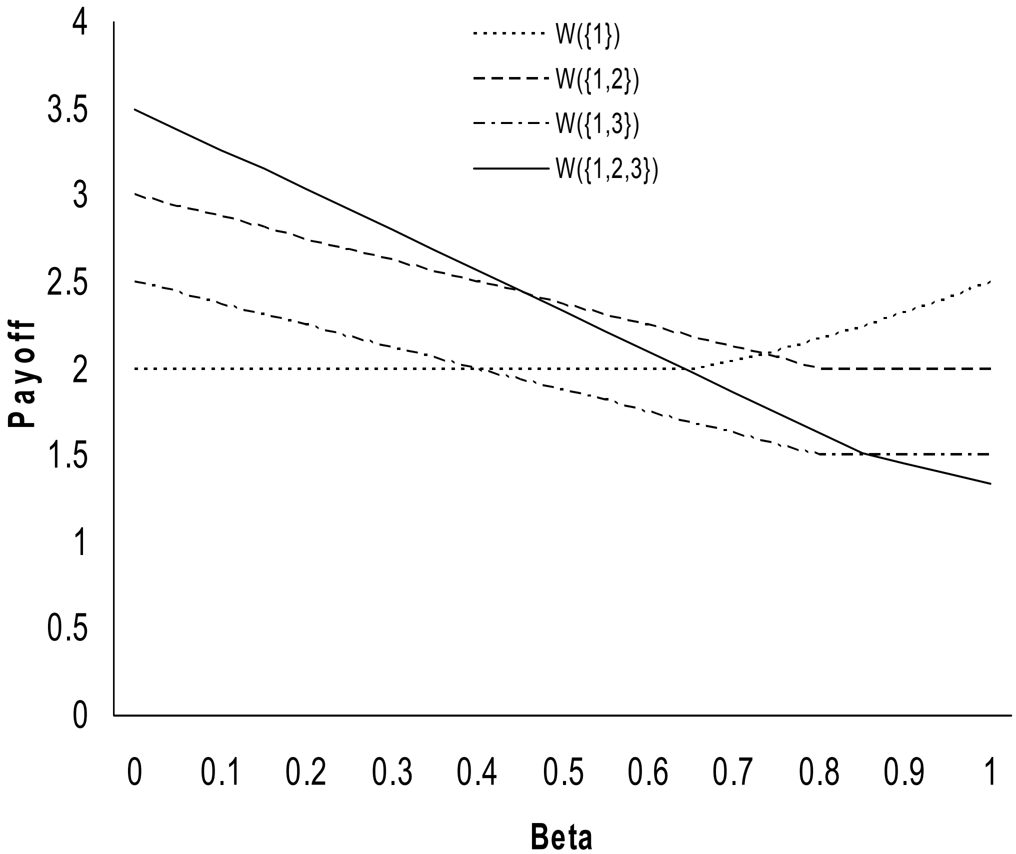

Figure 2: Formateur's Payoffs with Single Responsibility

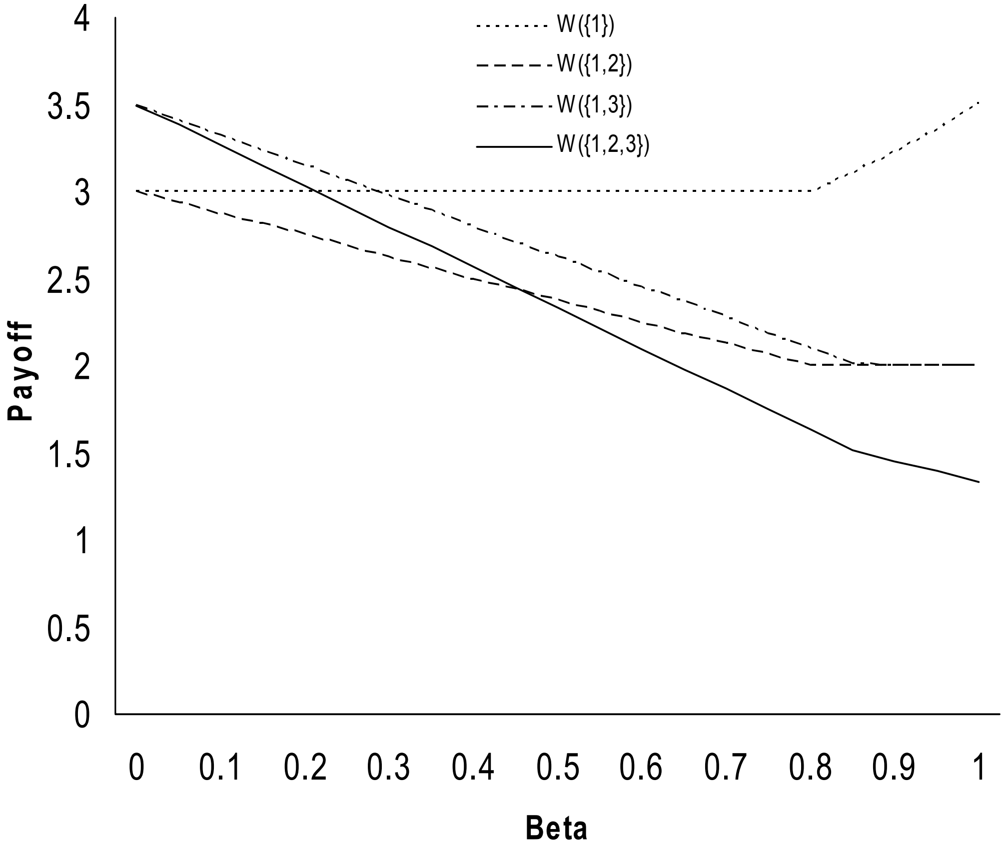

Figure 3: Average Government Duration

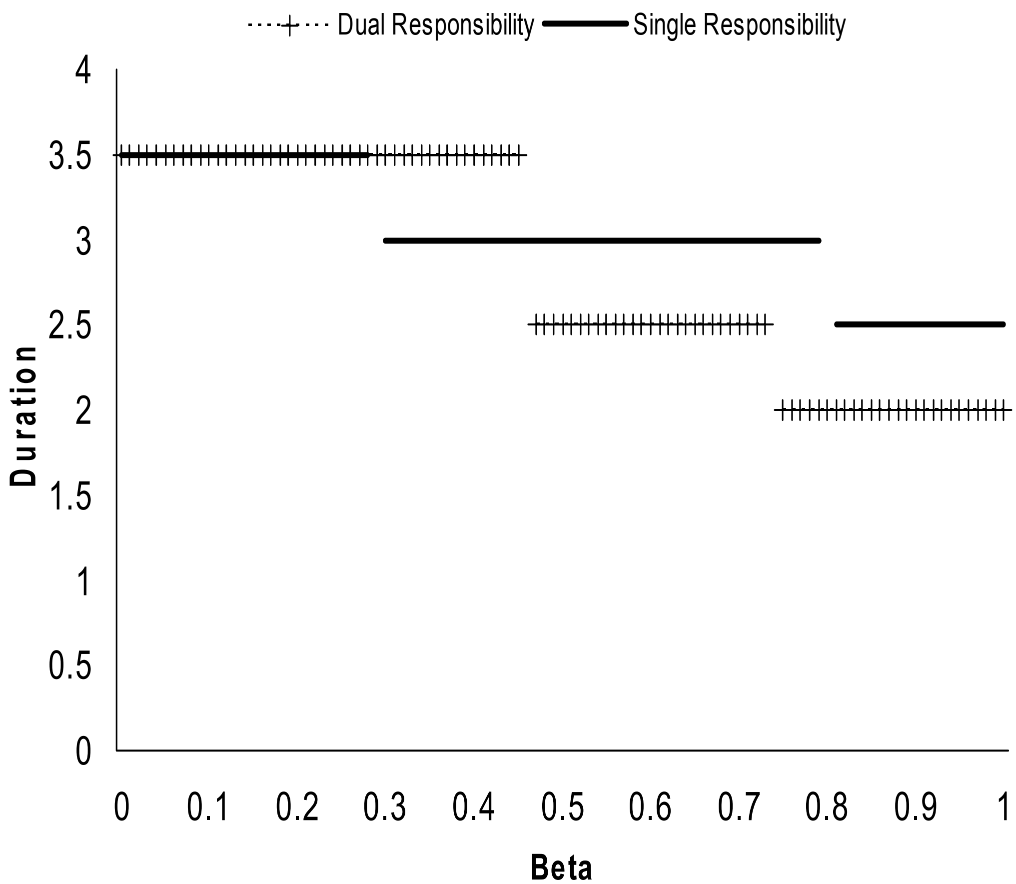

Table 1: Descriptive Statistics

Variable	Mean	Standard Deviation	Minimum	Maximum
Number of attempts	2.41	1.50	1	7
Government duration (days)	494.85	475.66	7	1502
Time to next election (days)	1208.27	361.48	133	1515
Number of parties	6.59	2.05	4	11
Size of government coalition (% in House)	61.91	12.27	34.20	84.90
Size of government coalition (% in Senate)	63.92	12.89	32.90	88.00
MINORITY	0.12	0.33	0	1
MINWIN	0.70	0.46	0	1
SURPLUS	0.18	0.39	0	1
MAJSENATE	0.97	0.17	0	1

Table 2: Maximum Likelihood Estimates

Parameter	**Estimate**	**Standard error**
α_0	9.768	3.753
α_1	2.217	0.575
α_2	1.865	0.476
β	0.885	0.115
γ_0	-2.170	0.909
γ_1	-0.165	0.642
γ_2	-2.026	0.737
γ_3	0.143	0.388
γ_4	-3.913	1.350
γ_5	1.291	0.660
γ_6	0.044	0.339
γ_7	2.310	0.484
δ_0	2.526	1.015
δ_1	-4.095	1.584
λ	-0.002	0.619
ρ	25.200	6.410
Log-likelihood	-408.515	

Table 3: Density Functions of Formateur Size and Goodness-of-fit Test

Interval	Data	Model
0-10%	0.000	0.017
10%-20%	0.000	0.008
20%-30%	0.147	0.149
30%-40%	0.618	0.558
40%-50%	0.147	0.181
50%+	0.088	0.088
χ^2 test	1.268	
$\Pr(\chi^2 (5) \geq 1.268)$	0.938	

Table 4: Density Functions of Negotiation Duration and Goodness-of-fit Test

Attempt	Data	Model
1	0.353	0.426
2	0.265	0.238
3	0.147	0.134
4	0.147	0.077
5	0.059	0.045
6	0.000	0.027
7	0.029	0.017
8+	0.000	0.036
χ^2 test $\Pr(\chi^2(7) \geq 4.109)$	4.109 0.767	
Mean number of attempts	2.412	2.405

Table 5: Density Functions of Government Duration and Goodness-of-fit Test

Interval	Data	Model
0-6 mo	0.353	0.335
6 mo-1 yr	0.235	0.178
1 yr-1.5 yr	0.059	0.121
1.5 yr-2 yr	0.088	0.090
2 yr-2.5 yr	0.059	0.073
2.5 yr-3 yr	0.029	0.062
3 yr-3.5 yr	0.088	0.058
3.5 yr-4 yr	0.088	0.083
χ^2 test	2.946	
$\Pr(\chi^2(7) \geq 2.946)$	0.890	
Mean government duration	495 days	487 days

Table 6: Density Functions of Government Size and Goodness-of-fit Test

Interval	Data	Model
0-10%	0.000	0.000
10%-20%	0.000	0.000
20%-30%	0.000	0.007
30%-40%	0.029	0.039
40%-50%	0.088	0.088
50%-60%	0.382	0.473
60%-70%	0.235	0.176
70%-80%	0.147	0.096
80%-90%	0.118	0.065
90%-100%	0.000	0.056
χ^2 test	5.808	
$\Pr(\chi^2(9) \geq 5.808)$	0.759	
Mean government coalition size	62%	61%

Table 7: Density Functions of Government Type and Goodness-of-fit Test

Type	Data	Model
Minority	12%	13%
Minimum winning	70%	65%
Surplus	18%	22%
χ^2 test	0.512	
$\Pr(\chi^2(2) \geq 0.512)$	0.774	

Table 8: Constitutional Experiment in Belgium

	ACTUAL (dual responsibility)	PREDICTED (dual responsibility)	PREDICTED (single responsibility)
Average Number of Attempts	2.4	2.4 (.04)	2.3 (.05)
Average Government Duration (days)	495	487 (72)	492 (73)
Average Government Size (% in the House)	62	61 (3)	40 (1)
% Minority Governments	12	13 (8)	86 (4)
% Min. Win. Governments	70	65 (10)	8 (4)
% Surplus Governments	18	22 (9)	6 (2)

* standard errors in parentheses

Table 9: Constitutional Change in Sweden

	BEFORE 1970 (dual responsibility)	**AFTER 1970 (single responsibility)**
Average Number of Attempts	1.3	1.1
Average Government Duration (days)	764	719
Average Government Size (% in the House)	52	43
% Minority Governments	42	86
% Min. Win. Governments	58	14
% Surplus Governments	0	0