Merlo, Antonio; Diermeier, Daniel; Eraslan, Hülya

Working Paper
Bicameralism and Government Formation

Nota di Lavoro, No. 81.2004

Provided in Cooperation with:
Fondazione Eni Enrico Mattei (FEEM)

Suggested Citation: Merlo, Antonio; Diermeier, Daniel; Eraslan, Hülya (2004) : Bicameralism and Government Formation, Nota di Lavoro, No. 81.2004, Fondazione Eni Enrico Mattei (FEEM), Milano

This Version is available at:
http://hdl.handle.net/10419/117965

Terms of use:
Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.
Bicameralism and Government Formation
Daniel Diermeier, Hülya Eraslan and Antonio Merlo

NOTA DI LAVORO 81.2004

MAY 2004
CTN – Coalition Theory Network

Daniel Diermeier, MEDS, Kellogg School of Management, Northwestern University
Hülya Eraslan, Finance Department, Wharton School, University of Pennsylvania
Antonio Merlo, Department of Economics, University of Pennsylvania and CEPR

This paper can be downloaded without charge at:
The Fondazione Eni Enrico Mattei Note di Lavoro Series Index:
http://www.feem.it/Feem/Pub/Publications/WPapers/default.htm

Social Science Research Network Electronic Paper Collection:
http://ssrn.com/abstract=XXXXXX

The opinions expressed in this paper do not necessarily reflect the position of Fondazione Eni Enrico Mattei
Bicameralism and Government Formation

Summary
In this paper we present a structural approach to the study of government formation in multi-party parliamentary democracies. The approach is based on the estimation of a stochastic bargaining model which we use to investigate the effects of specific institutional features of parliamentary democracy on the formation and stability of coalition governments. We then apply our methodology to estimate the effects of governmental bicameralism. Our main findings are that eliminating bicameralism does not affect 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 bicameralism affects the relative durability of coalitions of different sizes which in turn induces changes in the coalitions that are chosen in equilibrium.

Keywords: Political stability, Government formation, Government dissolution, Bicameralism, Comparative constitutional design

JEL Classification: D72, H19, C73

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.

This paper was presented at the 9th Coalition Theory Workshop on "Collective Decisions and Institutional Design" held in Barcelona, Spain, on 30-31 January 2004 and organised by the Universitat Autònoma de Barcelona.

Address for correspondence:

Antonio Merlo
Department of Economics
University of Pennsylvania
3718 Locust Walk
Philadelphia, PA 19104
USA
Phone: 215 898 7933
Fax: 215 573 2057
E-mail: merloa@econ.upenn.edu
1 Introduction

The formation and termination of coalition governments is one of the few literatures in political science with a tight connection between theoretical and empirical analysis. Over the last decade models of coalition formation have been predominantly using non-cooperative game theory (e.g. Baron 1993, Diermeier and Merlo 2000, Diermeier, Eraslan, and Merlo 2003, Diermeier and Stevenson 2000, Lupia and Strom 1995, Merlo 1997). In a recent paper Lupia and Strom (1995) argued that a similar approach can be used to study the duration of coalition governments. That is, coalition governments need to be sustained as equilibrium outcomes over time in the presence of potentially destabilizing changes to the political and economic environment, so-called "critical events" (Browne et. al. 1984, King et al. 1990, Warwick 1994).

On the one hand this approach marks a promising shift in the study of cabinet durations. In particular, the specification of explicit models of inter-party bargaining is likely to focus attention on the role of institutional features of the bargaining environment in determining cabinet failure. On the other hand, the bargaining approach creates various challenging methodological problems. First, Diermeier and Stevenson (2000) show that testing the Lupia-Strom model requires careful specifications of the stochastic model that preclude the usage of "off-the-shelf" event study methods. Second, Merlo (1997) pointed out that changing expectations about government duration (due to external events such as the release of macro-economic data) may lead party leaders to delay the formation of a government. Hence, governments that actually form should be viewed as the result of strategic selection by the members of the proto-coalition. Third, as Diermeier and Merlo (2000) have shown in a game-theoretic model, expectations about government duration may also influence which government is chosen in the first place. Together, these results imply that government type, formation time, and government duration are all simultaneously determined in equilibrium. That is, taking the concept of governments-as-equilibria seriously may require a radical
departure from existing empirical approaches that rely on regression-based reduced form specifications.

In this paper we present an alternative approach that involves structural estimation. By specifying a formal model we can interpret the observed data (type of government, duration etc.) as equilibrium phenomena. Once the model is fully specified and its parameters estimated we can then change key features of the model (e.g. constitutional characteristics) and then generate simulated data which can be compared to the original data to quantify the effect of constitutional changes. Specifically, we use this method to investigate the role of bicameralism on government formation and duration.

Bicameralism is one of the most salient constitutional features. It 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 formal 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 affect the internal institutional structure of legislatures, and Tsebelis and Money (1997), who explore the consequences of inter-chamber committees on legislative output. Our focus, however, is on governmental bicameralism (that is, a constitutional arrangement where multiple chambers share the right to appoint and remove members of the executive). In parliamentary democracies an emphasis on government formation (rather than the legislative process) is justified because stable governments are able to virtually dominate the legislative process leaving the legislative opposition with little influence over policy outcomes. In parliamentary systems, governmental bicameralism is present whenever the governing coalition has to maintain the confidence of both chambers of parliament to
stay in power. We henceforth refer to this constitutional feature as “dual responsibility.” In Western Europe, Italy, Belgium (until 1995), and Sweden (until 1970) are the only three countries with dual responsibility.¹

The investigation of dual responsibility, however, is important beyond its immediate practical application to constitutional debates (e.g., whether dual responsibility leads to shorter government duration). Rather, it presents an ideal test case to investigate the validity of some basic beliefs about the logic of government formation. For example, one of the more common beliefs about government formation is that minimal governments are the "normal" outcome of government formation and that minority or super-majority governments constitute an "anomaly" that needs to be explained. Of course, it is now well-known that minority and super-majority governments are quite typical and should not be interpreted as a crisis phenomenon (e.g. Strom 1990). However, this empirical reorientation did not lead to a corresponding theoretical shift. Existing accounts of minority governments, for example, focus on specific explanations why majority governments would not form. In his influential work Strom (1990), for example, suggests two such mechanisms: opposition parties may have other channels of influencing policy or they may fear to pay an electoral cost of joining an unpopular government. But this implies that in the absence of such factors (i.e. in the typical case) we should expect minimal winning governments to form. Calls for institutional reform in Italy and Belgium were guided by a similar concern. Dual responsibility, it was believed, encourages super-majority governments. Removing dual responsibility thus would lead to the "typical" case: minimal winning governments.

By studying dual responsibility in detail we can show that this intuition is incorrect. The theoretical model shows that formateurs face a fundamental trade-off between control (their share of the benefits from holding office) and durability (the size of the total benefits

¹In the case of bicameral parliaments without dual responsibility (like, for example, Germany), the upper chamber only plays a legislative role, but does not participate either in the appointment or the dismissal of the executive.
from holding office). The key insight is that if all potential governments are expected to be more stable, formateurs will switch from proposing more inclusive governments (e.g. super-majority governments) to less inclusive governments (e.g. minority governments). However, there is no reason that this equilibrium replacement effect will stop at minimal winning coalitions. Rather, minimal winning governments will form when the incentives between durability and control are balanced.

The key methodological point of this analysis is that we need to account for the equilibrium response of strategic party leaders in evaluating issues of constitutional design or reform. Just because potential governments may last longer does not imply that actual governments will be more durable, since government formation is the outcome of a strategic bargaining and selection process.

There is little existing 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 2002, 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. The second conclusion follows from the argument that, in order to pass legislation and hence implement policies, government coalitions need the support of a majority in both chambers of parliament.² In a recent empirical study of government formation and duration

²Lijphart’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
in West European bicameral parliamentary democracies, Druckman and Thies (2002) 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.\(^3\)

As described above we can use the estimated structural model to conduct (counterfactual) constitutional experiments. In our application we are interested in the consequences 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 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 provide some external validity on the importance of the equilibrium effects identified by our analysis.\(^4\)

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 qualify because even though the veto-powers of Germany’s upper house are limited, it represents state rather than federal or district-specific constituencies.

\(^3\)Note that Druckman and Thies (2002) do not estimate the effect of bicameralism (i.e. the constitutional feature \textit{per se}) 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.

\(^4\)Note that we cannot follow the same procedure for Belgium since there are not enough observations following the 1995 reform.
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.

Thus, our findings demonstrate that the intuition that the prima facie plausible belief that dual responsibility leads to less stable governments is unfounded. The key oversight is that both the 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 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.

2 Model

We consider a bargaining model of government formation in a bicameral parliamentary democracy with dual responsibility which generalizes the theoretical framework developed in Diermeier, Eraslan, and Merlo (2003). 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).\(^5\)

\(^5\)The shares are determined by the outcome of a general election which is not modeled here.
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 $G \subseteq N$,

$$U_i(x_i, G) = x_i + u^G_i,$$

where

$$u^G_i = \begin{cases} 
\varepsilon^G_i & \text{if } i \in G \\
\eta^G_i & \text{if } i \notin G,
\end{cases}$$

$\varepsilon^G_i > \eta^G_i$, $\varepsilon^G_i, \eta^G_i \in \mathbb{R}$. This specification captures the intuition that parties care both about the benefits from being in the government coalition and the identity of their coalition partners. In particular, $\varepsilon^G_i$ 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 summarize all policy related considerations in equation (2). The assumption that $\varepsilon^G_i > \eta^G_i$ 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 $T$ 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 $T$ 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 $\sigma$ with state space $\Sigma$ and probability distribution function $F_\sigma(\cdot)$.

\[6\text{For a richer, spatial model of government formation where government policies are endogenously determined, see Diermeier and Merlo (2000).}\]
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 $k \in N$ as the formateur. Following Laver and Shepsle (1996) and Baron (1993), we assume that the choice of a formateur is non-partisan and the head of state is non-strategic. In particular, we assume that each party $i \in N$ is selected to be a formateur with probability

$$p_i(\pi^H, \pi^S, k_{-1}) = \begin{cases} 
1 & \text{if } \pi^H_i > 0.5 \text{ or } \pi^S_i > 0.5 \text{ and } \pi^H_j \leq 0.5 , \forall j \in N \\
\exp(\alpha_0 \pi^H_i + \alpha_1 I_i) / \sum_{j \in N} \exp(\alpha_0 \pi^H_j + \alpha_1 I_j) & \text{if } \pi^C_j \leq 0.5 , \forall j \in N, \text{ for } C = H, S \\
0 & \text{if } \exists j \neq i : \pi^C_j > 0.5 , \text{ for } C = H \text{ or } C = S
\end{cases}$$

(3)

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 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.

The formateur then chooses a proto-coalition $D \in \Delta_k$, where $\Delta_k$ denotes the set of subsets of $N$ which contain $k$. Intuitively, a proto-coalition is a set of parties that agree to talk to each other about forming a government together. Let $\pi^D \equiv (\sum_{i \in D} \pi^H_i, \sum_{i \in D} \pi^S_i)$ 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.

---

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

8 There are no cases in the data where different parties have absolute majorities in different chambers.

9 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.
members, $x^D = (x^D_i)_{i \in D} \in R^{\lvert D \rvert}_+$. 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 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 $[0, \overline{T}]$.

Given the current state $s$ and the vector of (time-invariant) characteristics $(\overline{T}, Q, \pi^D)$, let
\[ y^D(s, \overline{T}, Q, \pi^D) \equiv E[T^D|s, \overline{T}, Q, \pi^D] \] (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
\[ X^D(s, \overline{T}, Q, \pi^D) \equiv \left\{ x^D \in R^{\lvert D \rvert}_+: \sum_{i \in D} x^D_i \leq y^D(s; \overline{T}, Q, \pi^D) \right\} \] (5)
denote the set of feasible payoff vectors to be allocated in that state, where $x^D_i$ 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 $k$ 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

\[10\] 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).
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 $\sigma$ and party $i \in D$ is selected to make a government proposal with probability

$$
\tilde{p}_i(\pi^H, \pi^S, D) = \begin{cases} 
1 & \text{if } \pi^H_i > 0.5 \text{ or } \pi^S_i > 0.5 \text{ and } \pi^H_j \leq 0.5, \forall j \in D \\
\frac{\exp(\alpha_1 \pi^H_i)}{\sum_{j \in D} \exp(\alpha_1 \pi^H_j)} & \text{if } \pi^C_j \leq 0.5, \forall j \in N, \text{ for } C = H, S \\
0 & \text{if } \exists j \neq i: \pi^C_j > 0.5, \text{ for } C = H \text{ or } C = S
\end{cases}
$$

(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 $(\tau^D, \chi^D)$ may be defined as a stopping time $\tau^D = 0, 1, \ldots$ and a $|D|$-dimensional random vector $\chi^D$ which satisfies $\chi^D \in X^D(\sigma_{\tau^D}, \mathcal{T}, Q, \pi^D)$ if $\tau^D < +\infty$ and $\chi^D = 0$ otherwise. Given a realization of $\sigma$, $\tau^D$ denotes the period in which a proposal is accepted by proto-coalition $D$, and $\chi^D$ denotes the proposed allocation that is accepted in state $\sigma_{\tau^D}$. Define $\beta^\infty = 0$. Then an outcome $(\tau^D, \chi^D)$ implies a von Neumann-Morgenstern payoff to each party $i \in D$ equal to $E[\beta^{\tau^D} \chi^D_i] + \varepsilon^D_i$, and a payoff to each party $j \in N \setminus D$ equal to $\eta^D_j$. Let

$$
V_k(D, \mathcal{T}, Q, \pi^D) \equiv E[\beta^{\tau^D} \chi^D_i].
$$

(7)

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

$$
W_k(D, \mathcal{T}, Q, \pi^D) = V_k(D, \mathcal{T}, Q, \pi^D) + \varepsilon^D_k.
$$

(8)

Hence, party $k$ chooses the proto-coalition to solve

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

(9)

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

### 2.1 Equilibrium Characterization
The characterization of the equilibrium of this model 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 \( y^D(s, T, Q, \pi^D) \geq y^*(D, T, Q, \pi^D) \), where \( y^*(\cdot) \) solves

\[
y^*(D, T, Q, \pi^D) = \beta \int \max\{y^D(s', T, Q, \pi^D), y^*(D, T, Q, \pi^D)\} dF_\sigma(s').
\]

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 \( \beta \)), their institutional environment (summarized by \( Q \)), the length of the time horizon to the next scheduled election (given by \( T \)), the size and composition of the proto-coalition (equal to \( \pi^D \) and \( D \), respectively), and the uncertainty about the future (summarized by the stochastic process \( \sigma \)).

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, 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

$$W_k(D, T, Q, \pi^D) = \left( \frac{1 - \beta (1 - \bar{p}_k(\pi^H, \pi^S, D))}{\beta} \right) y^*(D, T, Q, \pi^D) + \varepsilon_D^k. \quad (11)$$

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

$$D_k = \arg \max_{D \in \Delta_k} \left( \frac{1 - \beta (1 - \bar{p}_k(\pi^H, \pi^S, D))}{\beta} \right) y^*(D, T, Q, \pi^D) + \varepsilon_D^k, \quad (12)$$

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 $\beta$, its relative “bargaining power” $\tilde{p}_k(\cdot)$, and the formateur’s tastes for its coalition partners $\varepsilon_D^k$.

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 $\bar{p}_1 = 1/|D|$. 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, $T = 5$. There are two possible states of the world, $\Sigma = \{b, g\}$. Each state is realized with equal probability, $\Pr(\sigma =$
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.

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 $\beta \leq \frac{2}{3}$, then $y^*(\{1\}) = 3\beta/2 \leq y^{(1)}(b)$, which implies that delays never occur. If, on the other hand, $\beta > \frac{2}{3}$, 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

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

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

$$W_1(\{1, 2\}) = \begin{cases} \frac{5(2 - \beta)}{4} + \frac{1}{2} & \text{if } \beta \leq \frac{4}{5}, \\ 2 & \text{if } \beta > \frac{4}{5}. \end{cases}$$
and its equilibrium payoff from choosing proto-coalition \( \{1,3\} \) is equal to
\[
W_1(\{1,3\}) = \begin{cases} 
\frac{5(2-\beta)}{4} & \text{if } \beta \leq \frac{4}{7} \\
\frac{3}{2} & \text{if } \beta > \frac{4}{7} 
\end{cases}.
\]

Finally, consider the case where \( D = \{1,2,3\} \). It is easy to verify that if \( \beta \leq 6/7 \), then \( y^*(\{1,2,3\}) = 7\beta/2 \leq y^{(1,2,3)}(b) \), 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
\[
W_1(\{1,2,3\}) = \begin{cases} 
\frac{7(3-2\beta)}{6} & \text{if } \beta \leq \frac{6}{7} \\
\frac{4(3-2\beta)}{6-3\beta} & \text{if } \beta > \frac{6}{7} 
\end{cases}.
\]

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

Hence, the equilibrium proto-coalition choice of the formateur party 1 is given by\(^{11}\)
\[
D_1 = \begin{cases} 
\{1,2,3\} & \text{if } \beta \in (0,0.46) \\
\{1,2\} & \text{if } \beta \in (0.46,0.74) \\
\{1\} & \text{if } \beta \in (0.74,1)
\end{cases}.
\]

A relatively high degree of impatience would induce the formateur to choose a surplus coalition that would immediately agree to form the government.\(^{12}\) 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.\(^{13}\) Finally, for sufficiently low

\(^{11}\)Since ties are zero probability events, we are ignoring here the event of a tie between two alternatives.

\(^{12}\)Notice that when \( D = \{1,2,3\} \) and \( \beta \in (0,0.46) \) agreement occurs in both states of the world.

\(^{13}\)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 \( \beta \) 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. Also, without dual responsibility the expected duration of each possible coalition is likely to be longer.\textsuperscript{14}

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

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

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

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

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

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

\textsuperscript{14}See, e.g., Tsebelis (2000).
and its equilibrium payoff from choosing proto-coalition \( \{1, 2, 3\} \) is equal to

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

The equilibrium payoffs to the formateur party 1 associated with all possible proto-coalitions are depicted in Figure 2 as functions of the parameter \( \beta \).

Thus, in this case, the equilibrium proto-coalition choice of the formateur party 1 is given by

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

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 \( \beta \). 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 \( \beta \) 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 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 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, $k$, 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), $\tau^{D_k}$, 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 time horizon to the next scheduled election, $T$, the set of parties represented in the parliament, $N$, the vector of their relative seat shares, $\pi^H$ and $\pi^S$, 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. 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.

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 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, $(\bar{T}, Q, \pi^D)$. 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 sources 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.

We (the econometricians), however, do not observe the state of the world $s$.\footnote{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.} Hence, from the perspective of the econometrician, the cake $y^D(s, \bar{T}, Q, \pi^D) \equiv E[T^D| s, \bar{T}, Q, \pi^D]$ is also a random variable.\footnote{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.} Let $F_{y^D}(y| \bar{T}, Q, \pi^D)$ denote the conditional distribution of cakes
with conditional density \( f_y(\cdot | \cdot) \) defined over the support \([0, \bar{y}]\), and let \( F_T(t^D|y^D; T, Q, \pi^D) \) denote the conditional distribution of government durations with conditional density \( f_T(\cdot | \cdot) \) defined over the support \([0, \bar{T}]\), where \( \bar{y} < \bar{T} \) is the upper bound on the expectations over government duration and \( F_T(\cdot | \cdot) \) satisfies the restriction \( E[T^D|y^D; T, Q, \pi^D] = y^D \). Thus, from the point of view of the econometrician, \( y^*(D, T, Q, \pi^D) \) solves

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

and the probability of a negotiation lasting \( \tau \) rounds is equal to

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

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

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

Agreement implies that the expected government duration is above the threshold \( y^*(D, T, Q, \pi^D) \). 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.

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

\[\text{Note that } F_y(y^D|T, Q, \pi^D) \text{ and } F_T(t^D|y^D; T, Q, \pi^D) \text{ imply a distribution of } T^D \text{ conditional on } (T, Q, \pi^D).\]
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, $\varepsilon_k^D$. 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, $\varepsilon_k^D$. Hence, as above, from the perspective of the econometrician, $\varepsilon_k^D$ is a random variable. This implies that the expected payoff $W_k(D, T, Q, \pi^D)$ 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 $\varepsilon_k^D$, $D \in \Delta_k$, are independently and identically distributed according to a type I extreme value distribution with standard deviation $\rho$.\(^\text{18}\) 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

$$\Pr(D') = \Pr\left(W_k(D', T, Q, \pi^{D'}) > W_k(D, T, Q, \pi^D), \forall D \in \Delta_k\right)$$

$$= \exp\left(\frac{1-\beta(1-\exp(\pi^D))}{\beta \rho}\right)$$

$$\sum_{D \in \Delta_k} \exp\left(\frac{1-\beta(1-\exp(\pi^D))}{\beta \rho}\right).$$

(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 $(k, D_k, \tau^{D_k}, \ell_2, ..., \ell_{\tau}, \ell_k, t^{D_k})$ conditional on the vector of (exogenous) characteristics $Z = (T, Q, N, \pi, k_{-1})$, 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

\(^{18}\)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
\[
\Pr(k, D_k, \tau^{D_k}, \ell_2, ..., \ell_{\tau^{D_k}}, t^{D_k}|Z; \theta) = \Pr(k|Z; \theta) \times \\
\Pr(D_k|k, Z; \theta) \times \\
\Pr(\tau^{D_k}|D_k, k, Z; \theta) \times \\
\Pr(\ell_2, ..., \ell_{\tau^{D_k}}|\tau^{D_k}, D_k, k, Z; \theta) \times \\
\Pr(t^{D_k}|\tau^{D_k}, D_k, k, Z; \theta),
\]
(17)

where
\[
\Pr(k|Z; \theta) = p_k(\pi, k-1; \alpha_0, \alpha_1),
\]
\[
\Pr(D_k|k, Z; \theta) = \frac{\exp\left(\frac{[1-\beta(1-\tilde{p}_k(\pi, D_k, \alpha_3))]y^{\ast}(D_k, T, Q, \pi^{D_k})}{\beta p}\right)}{\sum_{D \in \Delta_k} \exp\left(\frac{[1-\beta(1-\tilde{p}_k(\pi, D_k, \alpha_3))]y^{\ast}(D, T, Q, \pi^{D_k})}{\beta p}\right)},
\]
\[
\Pr(\tau^{D_k}|D_k, k, Z; \theta) = \left[F_y(y^{\ast}(D_k, T, Q, \pi^{D_k})|T, Q, \pi^{D_k})\right]^{\tau^{D_k}-1} \left[1 - F_y(y^{\ast}(D_k, T, Q, \pi^{D_k})|T, Q, \pi^{D_k})\right],
\]
\[
\Pr(\ell_2, ..., \ell_{\tau^{D_k}}|\tau^{D_k}, D_k, k, Z; \theta) = \prod_{j=2}^{\tau^{D_k}} \tilde{p}_{\ell_j}(\pi, D_k; \alpha_2),
\]
and
\[
\Pr(t^{D_k}|\tau^{D_k}, D_k, k, Z; \theta) = \frac{\int y^{\ast}(\cdot) f_T(t^{D_k}|y^{D_k}; T, Q, \pi^{D_k})dF_y(y^{D_k}|T, Q, \pi^{D_k})}{1 - F_y(y^{\ast}(D_k, T, Q, \pi^{D_k})|T, Q, \pi^{D_k})}.
\]

The log-likelihood function is obtained by summing the logs of (17) over all the elements in the sample.\(^{19}\)

The next step consists of choosing flexible parametric functional forms for \(F_y(\cdot|\cdot)\) and \(F_T(\cdot|\cdot)\). We assume that \(F_y(\cdot|\cdot)\) and \(F_T(\cdot|\cdot)\) belong to the family of beta distributions.\(^{20}\)

\(^{19}\)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.

\(^{20}\)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.
particular, we let

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

(18)

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

where

\[
\gamma(T, Q, \pi^D) = \exp((\gamma_0 + \gamma_1 \pi^D)_{MINORITY} +
(\gamma_2 + \gamma_3 \pi^D)_{MINWIN} + 
(\gamma_4 + \gamma_5 \pi^D)_{SURPLUS} + 
\gamma_6 MAJSENATE + 
\gamma_7 T),
\]

(19)

and

\[
\overline{y}(T, Q) = \frac{\exp(\lambda)}{1 + \exp(\lambda)} T
\]

(20)

Furthermore, we let

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

(21)

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

\[
\delta(T, Q, \pi^D) = \exp(\delta_0 + \delta_1 T).
\]

(22)

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

\[
E[T^D | y^D; T, Q, \pi^D] = \left( \frac{\delta(T, Q, \pi^D) y^D}{\delta(T, Q, \pi^D) y^D + \delta(T, Q, \pi^D) - 1} \right) T = y^D.
\]

Several comments are in order. First, our parameterization of \(f_y(\cdot)\) and \(f_T(\cdot)\) 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. 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 $T$.

4 Results

Table 2 presents the maximum likelihood estimates of the parameters of the model, $(\alpha, \beta, \gamma, \delta, \lambda, \rho)$, where $\alpha = (\alpha_0, \alpha_1, \alpha_2)$, $\gamma = (\gamma_0, ..., \gamma_7)$, 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 $\chi^2$ test

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

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.

The results from table 3-7 show that the model performs remarkably well in reproducing all aggregate features of the data. Moreover, the $\chi^2$ goodness-of-fit test never rejects the model at conventional significance levels. 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

---

21 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).
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. In particular, we replace $\pi^S = (0, \ldots, 0)$ for all elections and we set $\text{MAJSENATE} = 1$ for all possible coalitions.

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%).

To provide an external point of comparison we consider the outcomes of a similar constitutional reform implemented in Sweden in 1970. The results of this reform are reported in Table 9. In this table, column 1 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).\footnote{As explained in Diermeier, Eraslan, and Merlo (2003), the lack of surplus governments in Sweden (but also in Denmark and Norway) is due to a constitutional feature known as \textit{negative parliamentarism}. This feature is not present in the Belgian constitution.}
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, 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 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 of 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) that rely on coalition specific characteristics (such as the coalition’s majority status) or the political context of government formation (e.g. the number of formation attempts) as exogenous variables in a regression model. As shown in our analysis, 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 inferences. We hope to explore the implications of these insights further in future research.
References


ment in Twenty-one Countries. New Haven: Yale University Press.


Cambridge University Press.
Table 1: Descriptive Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of attempts</td>
<td>2.41</td>
<td>1.50</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Government duration (days)</td>
<td>494.85</td>
<td>475.66</td>
<td>7</td>
<td>1502</td>
</tr>
<tr>
<td>Time to next election (days)</td>
<td>1208.27</td>
<td>361.48</td>
<td>133</td>
<td>1515</td>
</tr>
<tr>
<td>Number of parties</td>
<td>6.59</td>
<td>2.05</td>
<td>4</td>
<td>11</td>
</tr>
<tr>
<td>Size of government coalition (% in House)</td>
<td>61.91</td>
<td>12.27</td>
<td>34.20</td>
<td>84.90</td>
</tr>
<tr>
<td>Size of government coalition (% in Senate)</td>
<td>63.92</td>
<td>12.89</td>
<td>32.90</td>
<td>88.00</td>
</tr>
<tr>
<td>MINORITY</td>
<td>0.12</td>
<td>0.33</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>MINWIN</td>
<td>0.70</td>
<td>0.46</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>SURPLUS</td>
<td>0.18</td>
<td>0.39</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>MAJSENATE</td>
<td>0.97</td>
<td>0.17</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>
Table 2: Maximum Likelihood Estimates

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimate</th>
<th>Standard error</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\alpha_0$</td>
<td>9.768</td>
<td>3.753</td>
</tr>
<tr>
<td>$\alpha_1$</td>
<td>2.217</td>
<td>0.575</td>
</tr>
<tr>
<td>$\alpha_2$</td>
<td>1.865</td>
<td>0.476</td>
</tr>
<tr>
<td>$\beta$</td>
<td>0.885</td>
<td>0.115</td>
</tr>
<tr>
<td>$\gamma_0$</td>
<td>-2.170</td>
<td>0.909</td>
</tr>
<tr>
<td>$\gamma_1$</td>
<td>-0.165</td>
<td>0.642</td>
</tr>
<tr>
<td>$\gamma_2$</td>
<td>-2.026</td>
<td>0.737</td>
</tr>
<tr>
<td>$\gamma_3$</td>
<td>0.143</td>
<td>0.388</td>
</tr>
<tr>
<td>$\gamma_4$</td>
<td>-3.913</td>
<td>1.350</td>
</tr>
<tr>
<td>$\gamma_5$</td>
<td>1.291</td>
<td>0.660</td>
</tr>
<tr>
<td>$\gamma_6$</td>
<td>0.044</td>
<td>0.339</td>
</tr>
<tr>
<td>$\gamma_7$</td>
<td>2.310</td>
<td>0.484</td>
</tr>
<tr>
<td>$\delta_0$</td>
<td>2.526</td>
<td>1.015</td>
</tr>
<tr>
<td>$\delta_1$</td>
<td>-4.095</td>
<td>1.584</td>
</tr>
<tr>
<td>$\lambda$</td>
<td>-0.002</td>
<td>0.619</td>
</tr>
<tr>
<td>$\rho$</td>
<td>25.200</td>
<td>6.410</td>
</tr>
</tbody>
</table>

Log-likelihood: -408.515
Table 3: Density Functions of Formateur Size and Goodness-of-fit Test

<table>
<thead>
<tr>
<th>Interval</th>
<th>Data</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10%</td>
<td>0.000</td>
<td>0.017</td>
</tr>
<tr>
<td>10%-20%</td>
<td>0.000</td>
<td>0.008</td>
</tr>
<tr>
<td>20%-30%</td>
<td>0.147</td>
<td>0.149</td>
</tr>
<tr>
<td>30%-40%</td>
<td>0.618</td>
<td>0.558</td>
</tr>
<tr>
<td>40%-50%</td>
<td>0.147</td>
<td>0.181</td>
</tr>
<tr>
<td>50%+</td>
<td>0.088</td>
<td>0.088</td>
</tr>
</tbody>
</table>

χ² test       | 1.268
Pr(χ² (5) ≥ 1.268) | 0.938
Table 4: Density Functions of Negotiation Duration and Goodness-of-fit Test

<table>
<thead>
<tr>
<th>Attempt</th>
<th>Data</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.353</td>
<td>0.426</td>
</tr>
<tr>
<td>2</td>
<td>0.265</td>
<td>0.238</td>
</tr>
<tr>
<td>3</td>
<td>0.147</td>
<td>0.134</td>
</tr>
<tr>
<td>4</td>
<td>0.147</td>
<td>0.077</td>
</tr>
<tr>
<td>5</td>
<td>0.059</td>
<td>0.045</td>
</tr>
<tr>
<td>6</td>
<td>0.000</td>
<td>0.027</td>
</tr>
<tr>
<td>7</td>
<td>0.029</td>
<td>0.017</td>
</tr>
<tr>
<td>8+</td>
<td>0.000</td>
<td>0.036</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>$\chi^2$ test</th>
<th>4.109</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pr($\chi^2 (7) \geq 4.109$)</td>
<td>0.767</td>
</tr>
</tbody>
</table>

Mean number of attempts | 2.412 | 2.405 |
Table 5: Density Functions of Government Duration and Goodness-of-fit Test

<table>
<thead>
<tr>
<th>Interval</th>
<th>Data</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-6 mo</td>
<td>0.353</td>
<td>0.335</td>
</tr>
<tr>
<td>6 mo-1 yr</td>
<td>0.235</td>
<td>0.178</td>
</tr>
<tr>
<td>1 yr-1.5 yr</td>
<td>0.059</td>
<td>0.121</td>
</tr>
<tr>
<td>1.5 yr-2 yr</td>
<td>0.088</td>
<td>0.090</td>
</tr>
<tr>
<td>2 yr-2.5 yr</td>
<td>0.059</td>
<td>0.073</td>
</tr>
<tr>
<td>2.5 yr-3 yr</td>
<td>0.029</td>
<td>0.062</td>
</tr>
<tr>
<td>3 yr-3.5 yr</td>
<td>0.088</td>
<td>0.058</td>
</tr>
<tr>
<td>3.5 yr-4 yr</td>
<td>0.088</td>
<td>0.083</td>
</tr>
</tbody>
</table>


<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>$\chi^2$ test</td>
<td>2.946</td>
</tr>
<tr>
<td>$\Pr(\chi^2 (7) \geq 2.946)$</td>
<td>0.890</td>
</tr>
</tbody>
</table>

| Mean government duration | 495 days | 487 days |
Table 6: Density Functions of Government Size and Goodness-of-fit Test

<table>
<thead>
<tr>
<th>Interval</th>
<th>Data</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10%</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>10%-20%</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>20%-30%</td>
<td>0.000</td>
<td>0.007</td>
</tr>
<tr>
<td>30%-40%</td>
<td>0.029</td>
<td>0.039</td>
</tr>
<tr>
<td>40%-50%</td>
<td>0.088</td>
<td>0.088</td>
</tr>
<tr>
<td>50%-60%</td>
<td>0.382</td>
<td>0.473</td>
</tr>
<tr>
<td>60%-70%</td>
<td>0.235</td>
<td>0.176</td>
</tr>
<tr>
<td>70%-80%</td>
<td>0.147</td>
<td>0.096</td>
</tr>
<tr>
<td>80%-90%</td>
<td>0.118</td>
<td>0.065</td>
</tr>
<tr>
<td>90%-100%</td>
<td>0.000</td>
<td>0.056</td>
</tr>
</tbody>
</table>

| χ² test | 5.808 |
| Pr(χ² (9) ≥ 5.808) | 0.759 |

Mean government coalition size | 62% | 61% |
Table 7: Density Functions of Government Type and Goodness-of-fit Test

<table>
<thead>
<tr>
<th>Type</th>
<th>Data</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minority</td>
<td>12%</td>
<td>13%</td>
</tr>
<tr>
<td>Minimum winning</td>
<td>70%</td>
<td>65%</td>
</tr>
<tr>
<td>Surplus</td>
<td>18%</td>
<td>22%</td>
</tr>
</tbody>
</table>

$\chi^2$ test  
Pr($\chi^2 (2) \geq 0.512$)  

0.512  
0.774
<table>
<thead>
<tr>
<th></th>
<th><strong>ACTUAL</strong> (dual responsibility)</th>
<th><strong>PREDICTED</strong> (dual responsibility)</th>
<th><strong>PREDICTED</strong> (single responsibility)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Number of Attempts</td>
<td>2.4</td>
<td>2.4</td>
<td>2.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(.04)</td>
<td>(.05)</td>
</tr>
<tr>
<td>Average Government Duration (days)</td>
<td>495</td>
<td>487</td>
<td>492</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(72)</td>
<td>(73)</td>
</tr>
<tr>
<td>Average Government Size (% in the House)</td>
<td>62</td>
<td>61</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(3)</td>
<td>(1)</td>
</tr>
<tr>
<td>% Minority Governments</td>
<td>12</td>
<td>13</td>
<td>86</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(8)</td>
<td>(4)</td>
</tr>
<tr>
<td>% Min. Win. Governments</td>
<td>70</td>
<td>65</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(10)</td>
<td>(4)</td>
</tr>
<tr>
<td>% Surplus Governments</td>
<td>18</td>
<td>22</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(9)</td>
<td>(2)</td>
</tr>
</tbody>
</table>

* standard errors in parentheses
Table 9: Constitutional Change in Sweden

<table>
<thead>
<tr>
<th></th>
<th>BEFORE 1970 (dual responsibility)</th>
<th>AFTER 1970 (single responsibility)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Number of Attempts</td>
<td>1.3</td>
<td>1.1</td>
</tr>
<tr>
<td>Average Government Duration (days)</td>
<td>764</td>
<td>719</td>
</tr>
<tr>
<td>Average Government Size (% in the House)</td>
<td>52</td>
<td>43</td>
</tr>
<tr>
<td>% Minority Governments</td>
<td>42</td>
<td>86</td>
</tr>
<tr>
<td>% Min. Win. Governments</td>
<td>58</td>
<td>14</td>
</tr>
<tr>
<td>% Surplus Governments</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Figure 1: Formateur's Payoffs with Dual Responsibility

- \( W(\{1\}) \)
- \( W(\{1,2\}) \)
- \( W(\{1,3\}) \)
- \( W(\{1,2,3\}) \)
Figure 2: Formateur's Payoffs with Single Responsibility

0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1

Beta

0 0.5 1 1.5 2 2.5 3 3.5 4

Payoff

W(\{1\})
W(\{1,2\})
W(\{1,3\})
W(\{1,2,3\})
Figure 3: Average Government Duration

- Dual Responsibility
- Single Responsibility
Our Note di Lavoro are available on the Internet at the following addresses:
http://www.feem.it/Feem/Pub/Publications/WPapers/default.html

NOTE DI LAVORO PUBLISHED IN 2003

PRIV 2.2003 Ibolya SCHINDELE: Theory of Privatization in Eastern Europe: Literature Review
PRIV 3.2003 Wietze LISE, Claudia KEMFERT and Richard S.J. TOL: Strategic Action in the Liberalised German Electricity Market
KNOW 5.2003 Reyer GERLAGH: Induced Technological Change under Technological Competition
ETA 6.2003 Efterm CASTELNUOVO: Squeezing the Interest Rate Smoothing Weight with a Hybrid Expectations Model
SIEV 7.2003 Anna ALBERINI, Alberto LONGO, Stefania TONIN, Francesco TROMBETTA and Margherita TURVANI: The Role of Liability, Regulation and Economic Incentives in Brownfield Remediation and Redevelopment: Evidence from Surveys of Developers
NRM 8.2003 Elissaios PAPYRAKIS and Reyer GERLAGH: Natural Resources: A Blessing or a Curse?
CLIM 9.2003 A. CAPARROS, J.-C. PEREAU and T. TAZDAÏT: North-South Climate Change Negotiations: a Sequential Game with Asymmetric Information
KNOW 10.2003 Giorgio BRUNELLO and Daniele CHECCHI: School Quality and Family Background in Italy
CLIM 11.2003 Efterm CASTELNUOVO and Marzio GALEOTTI: Learning By Doing vs Learning By Researching in a Model of Climate Change Policy Analysis
KNOW 12.2003 Carole MAIGNAN, Gianmarco OTTAVIANO and Dino PINELLI (eds.): Economic Growth, Innovation, Cultural Diversity: What are we all talking about? A critical survey of the state-of-the-art
KNOW 14.2003 Maddy JANSSENS and Chris STEYAERT (lix): Theories of Diversity within Organisation Studies: Debates and Future Trajectories
KNOW 15.2003 Tuzin BAYCAN LEVENT, Enno MASUREL and Peter NIJKAMP (lix): Diversity in Entrepreneurship: Ethnic and Female Roles in Urban Entrepreneurial Life
KNOW 16.2003 Alexandro BITUSIKOVA (lix): Post-Communist City on its Way from Grey to Colourful: The Case Study from Slovakia
KNOW 17.2003 Billy E. VAUGHN and Katarina MLEKOV (lix): A Stage Model of Developing an Inclusive Community
KNOW 18.2003 Selma van LONDON and Arie de RUIJTER (lix): Managing Diversity in a Glocalizing World
Theory Network
PRIV 20.2003 Giacomo CALZOLARI and Alessandro PAVAN (lix): Monopoly with Resale
PRIV 22.2003 Marco LiCalzi and Alessandro PAVAN (lix): Tilting the Supply Schedule to Enhance Competition in Uniform-Price Auctions
PRIV 23.2003 David ETTINGER (lix): Bidding among Friends and Enemies
PRIV 24.2003 Hanna VARTIAINEN (lix): Auction Design without Commitment
PRIV 26.2003 Christine A. PARLOUR and Uday RAJAN (ix): Rationing in IPOs
PRIV 27.2003 Kjell G. NYBORG and Ilya A. STREBULAEV (ix): Multiple Unit Auctions and Short Squeezes
PRIV 28.2003 Anders LUNANDER and Jan-Eric NILSSON (ix): Taking the Lab to the Field: Experimental Tests of Alternative Mechanisms to Procure Multiple Contracts
PRIV 30.2003 Emetal MAASLAND and Sander ONDERSTAL (ix): Auctions with Financial Externalities
ETA 31.2003 Michael FINUS and Bianca RUNDHAGEN: A Non-cooperative Foundation of Core-Stability in Positive Externality NTU-Coalition Games
KNOW 32.2003 Michele MORETTO: Competition and Irreversible Investments under Uncertainty
PRIV 33.2003 Philippe QUIRION: Relative Quotas: Correct Answer to Uncertainty or Case of Regulatory Capture?
KNOW 34.2003 Giuseppe MEDA, Claudio PIGA and Donald SIEGEL: On the Relationship between R&D and Productivity: A Treatment Effect Analysis
ETA 35.2003 Alessandra DEL BOCA, Marzio GALEOTTI and Paolo ROTA: Non-convexities in the Adjustment of Different Capital Inputs: A Firm-level Investigation
GG 36.2003  Matthieu GLACHANT: Voluntary Agreements under Endogenous Legislative Threats
PRIV 37.2003  Naïjess BOUBAKRI, Jean-Claude COSET and Omrane GUEDHAMI: Postprivatization Corporate Governance: the Role of Ownership Structure and Investor Protection
CLIM 38.2003  Rolf GOLOMBEK and Michael HOEL: Climate Policy under Technology Spillovers
KNOW 39.2003  Stijn BEN YOUSSEF: Transboundary Pollution, R&D Spillovers and International Trade
CTN 40.2003  Carlo CARRARO and Carmen MARCHIORI: Endogenous Strategic Issue Linkage in International Negotiations
KNOW 42.2003  Timo GOESCHL and Timothy SWANSON: On Biology and Technology: The Economics of Managing Biotechnologies
CLIM 44.2003  Katrin MILLOCK and Céline NAUGES: The French Tax on Air Pollution: Some Preliminary Results on its Effectiveness
PRIV 45.2003  Bernardo BORTOLOTTI and Paolo PINOTTI: The Political Economy of Privatization
ETA 47.2003  Jens HORBACH: Employment and Innovations in the Environmental Sector: Determinants and Econometrical Results for Germany
CLIM 48.2003  Lori SNYDER, Nolan MILLER and Robert STAVINS: The Effects of Environmental Regulation on Technology Diffusion: The Case of Chlorine Manufacturing
CTN 50.2003  László A. KOCZY and Luc LAUWERS (lxii): The Minimal Dominant Set is a Non-Empty Core-Extension
CTN 51.2003  Matthew O. JACKSON (lxii): Allocation Rules for Network Games
CTN 52.2003  Ana MAULEON and Vincent VANNETELBOSCH (lxii): Farsightedness and Cautiousness in Coalition Formation
CTN 54.2003  Matthew HAAG and Roger LAGUNOFF (lxii): On the Size and Structure of Group Cooperation
CTN 55.2003  Taiji FURUSAWA and Hideo KONISHI (lxii): Free Trade Networks
CTN 56.2003  Halis Murat YILDIZ (lxii): National Versus International Mergers and Trade Liberalization
CTN 57.2003  Santiago RUBIO and Alistair ULPH (lxii): An Infinite-Horizon Model of Dynamic Membership of International Environmental Agreements
KNOW 58.2003  Carole MAIGNAN, Dino PINELLI and Gianmarco I.P. OTTAVIANO: ICT, Clusters and Regional Cohesion: A Summary of Theoretical and Empirical Research
KNOW 59.2003  Giorgio BELLETTINI and Gianmarco I.P. OTTAVIANO: Special Interests and Technological Change
ETA 60.2003  Ronnie SCHOB: The Double Dividend Hypothesis of Environmental Taxes: A Survey
CLIM 61.2003  Michael FINUS, Ekko van IERLAND and Robert DELLINK: Stability of Climate Coalitions in a Cartel Formation Game
SIEV 63.2003  Alberto PETRUCCI: Taxing Land Rent in an Open Economy
CLIM 64.2003  Joseph E. ALDY, Scott BARRETT and Robert N. STAVINS: Thirteen Plus One: A Comparison of Global Climate Policy Architectures
SIEV 65.2003  Edi DEFRANCESCO: The Beginning of Organic Fish Farming in Italy
SIEV 66.2003  Klaus CONRAD: Price Competition and Product Differentiation when Consumers Care for the Environment
CLIM 68.2003  Zhongxiang ZHANG: Open Trade with the U.S. Without Compromising Canada’s Ability to Comply with its Kyoto Target
KNOW 69.2003  David FRANTZ (lxii): Lorenzo Market between Diversity and Mutation
KNOW 70.2003  Ercole SORI (lxii): Mapping Diversity in Social History
KNOW 71.2003  Lilijana DERU SIMIC (lxii): What is Specific about Art/Cultural Projects?
KNOW 72.2003  Natalya V. TARANOVA (lxii): The Role of the City in Fostering Intergroup Communication in a Multicultural Environment: Saint-Petersburg’s Case
KNOW 73.2003  Kristine CRANE (lxii): The City as an Arena for the Expression of Multiple Identities in the Age of Globalisation and Migration
KNOW 74.2003  Kazuma MATOBA (lxii): Global Dialogue- Transformation through Transcultural Communication
KNOW 75.2003  Catarina REIS OLIVEIRA (lxii): Immigrants’ Entrepreneurial Opportunities: The Case of the Chinese in Portugal
KNOW 76.2003  Sandra WALLMAN (lxii): The Diversity of Diversity - towards a typology of urban systems
KNOW 77.2003  Richard PEARCE (lxii): A Biologist’s View of Individual Cultural Identity for the Study of Cities
KNOW 78.2003  Vincent MERK (lxii): Communication Across Cultures: from Cultural Awareness to Reconciliation of the Dilemmas
KNOW 79.2003  Giorgio BELLETTINI, Carlotta BERTI CERONI and Gianmarco I.P. OTTAVIANO: Child Labor and Resistance to Change
ETA 80.2003  Michele MORETTO, Paolo M. PANTEGHINI and Carlo SCARPA: Investment Size and Firm’s Value under Profit Sharing Regulation
NOTE DI LAVORO PUBLISHED IN 2004

IEM 1.2004 Anil MARKANDYA, Suzette PEDROSO and Alexander GOLUB: Empirical Evidence of National Income and So2 Emissions in Selected European Countries

ETA 2.2004 Masahisa FUJITA and Shlomo WEBER: Strategic Immigration Policies and Welfare in Heterogeneous Countries

PRA 3.2004 Adolfo DI CARLUCCIO, Giovanni FERRI, Cecilia FRALE and Ottavio RICCHI: Do Privatizations Boost Household Shareholding? Evidence from Italy

 ETA 4.2004 Victor GINSBURGH and Shlomo WEBER: Languages Disenfranchisement in the European Union


PRA 7.2004 Sandro BRUSCO, Giuseppe LOPOMO and S. VISWANATHAN (lxxiv): Merger Mechanisms

PRA 8.2004 Wolfgang AUSSENEGGER, Pegaret PICHLER and Alex STOMPER (lxxv): IPO Pricing with Bookbuilding, and a When-Issued Market

PRA 9.2004 Pegaret PICHLER and Alex STOMPER (lxxv): Primary Market Design: Direct Mechanisms and Markets


PRA 11.2004 Bjarni BRENDSTRUP and Harry J. PAARSCH (lxxvi): Nonparametric Identification and Estimation of Multi-Unit, Sequential, Oral, Ascending-Price Auctions With Asymmetric Bidders

PRA 12.2004 Ohad KADAN (lxxvi): Equilibrium in the Two Player, k-Doublе Auction with Affiliated Private Values

PRA 13.2004 Maarten C.W. JANSEN (lxxv): Auctions as Coordination Devices

PRA 14.2004 Gadi FIBICH, Arieh GAVIOUS and Aner SELA (lxxv): All-Pay Auctions with Weakly Risk-Averse Buyers

PRA 15.2004 Orly SADE, Charles SCHNITZLEIN and Jaime F. ZENDER (lxxvi): Competition and Cooperation in Divisible Good Auctions: An Experimental Examination

PRA 16.2004 Marcin STRYSZOWSKA (lxxvii): Late and Multiple Bidding in Competing Second Price Internet Auctions

CCMP 17.2004 Jörg Ben YOUSSEF (lxxvii): R&D in Cleaner Technology and International Trade

NRM 18.2004 Angelo ANTOCI, Simone BORGHESI and Paolo RUSSU (lxxviii): Biodiversity and Economic Growth: Stabilization Versus Preservation of the Ecological Dynamics

SIEV 19.2004 Anna ALBERINI, Paolo ROSATO, Alberto LONGO and Valentina ZANATTA: Information and Willingness to Pay in a Contingent Valuation: The Value of S. Erasmo in the Lagoon of Venice


NRM 21.2004 Jacqueline M. HAMILTON (lxxviii): Climate and the Destination Choice of German Tourists


NRM 23.2004 Pius ODUNGA and Henrik FOLMER (lxxviii): Profiling Tourists for Balanced Utilization of Tourism-Based Resources in Kenya


NRM 26.2004 Juan Luis EUGENIO-MARTÍN, Noelia MARTÍN MORALES and Riccardo SCARPA (lxxvii): Tourism and Economic Growth in Latin American Countries: A Panel Data Approach

NRM 27.2004 Raúl Hernández MARTÍN (lxxvii): Impact of Tourism Consumption on GDP. The Role of Imports


NRM 29.2004 Marian WEBER (lxxvi): Assessing the Effectiveness of Tradable Landuse Rights for Biodiversity Conservation: an Application to Canada's Boreal Mixedwood Forest

NRM 30.2004 Tord BJØRNDAL, Phoebe KOUNDOURI and Sean PASCOE (lxxvi): Output Substitution in Multi-Species Trawl Fisheries: Implications for Quota Setting


CTN 33.2004 Wilson PEREZ: Divide and Conquer: Noisy Communication in Networks, Power, and Wealth Distribution


ETA 39.2004 Alberto CAVALIERE: Price Competition with Information Disparities in a Vertically Differentiated Duopoly

PRA 40.2004 Andrea BIGANO and Stef PROOST: The Opening of the European Electricity Market and Environmental Policy: Does the Degree of Competition Matter?

CCMP 41.2004 Micheal FINUS (lxxxi): International Cooperation to Resolve International Pollution Problems
Francesco CRESPI: Notes on the Determinants of Innovation: A Multi-Perspective Analysis

Sergio CURRARINI and Marco MARINI: Coalition Formation in Games without Synergies

Marc ESCRÍHUELA-VILLAR: Cartel Sustainability and Cartel Stability

Sebastian BEROVETS and Nicolas GRAVEL: Appraising Diversity with an Ordinal Notion of Similarity: An Axiomatic Approach

Signe ANTHON and Bo JELLESMARK THORSEN: Optimal Afforestation Contracts with Asymmetric Information on Private Environmental Benefits


Ekin BIROL, Ágnes GYOVAI and Melinda SMALE: Using a Choice Experiment to Value Agricultural Biodiversity on Hungarian Small Farms: Agri-Environmental Policies in a Transition al Economy

Gernot KLEPPER and Sonja PETERSON: The EU Emissions Trading Scheme, Allowance Prices, Trade Flows, Competitiveness Effects

Scott BARRETT and Michael HOEL: Optimal Disease Eradication

Dinko DIMITROV, Peter BORM, Raúd HENDRICKX and Shao CHIN SUNG: Simple Priorities and Core Stability in Hedonic Games

Francesco RICCI: Channels of Transmission of Environmental Policy to Economic Growth: A Survey of the Theory

Anna ÁLIBERIN, Maureen CROPPER, Alan KRUPNICK and Nathalie B. SIMON: Willingness to Pay for Mortality Risk Reductions: Does Latency Matter?

Ingo BRAUER and Rainer MARGGRAF: Valuation of Ecosystem Services Provided by Biodiversity Conservation: An Integrated Hydrological and Economic Model to Value the Enhanced Nitrogen Retention in Renaturated Streams

Tim Goeschl and Tun LIN: Biodiversity Conservation on Private Lands: Information Problems and Regulatory Choices

Tom DEDEURWAERDERE: Bioprospection: From the Economics of Contracts to Reflexive Governance

Katrin REHDANZ and David MADDISON: The Amenity Value of Climate to German Households

Koen SMEKENS and Bob VAN DER ZWAAN: Environmental Externalities of Geological Carbon Sequestration Effects on Energy Scenarios

Valentina BOSETTI, Mariaester CASSINELLI and Alessandro LANZA: Using Data Envelopment Analysis to Evaluate Environmentally Conscious Tourism Management

Tim Goeschl and Danilo CAMARGO IGLIORI: Property Rights Conservation and Development: An Analysis of Extractive Reserves in the Brazilian Amazon

Barbara BUCHNER and Carlo CARRARO: Economic and Environmental Effectiveness of a Technology-based Climate Protocol

Elissaios PAPYRAKIS and Reyer GERLAGH: Resource-Abundance and Economic Growth in the U.S.

Györgyi BELA, György PATAKI, Melinda SMALE and Mariann HAJDÚ: Conserving Crop Genetic Resources on Smallholder Farms in Hungary: Institutional Analysis

E.C.M. RUIJGROK and E.E.M. NILLESEN: The Socio-Economic Value of Natural Riverbanks in the Netherlands


Giannis VARDAS and Anastasios XEPAPADEAS: Uncertainty Aversion, Robust Control and Asset Holdings

Anastasios XEPAPADEAS and Constanzia PASSA: Participation in and Compliance with Public Voluntary Environmental Programs: An Evolutionary Approach

Michael FINUS: Modesty Pays: Sometimes!

Trond BJØRNDAL and Ana BRASÃO: The Northern Atlantic Bluefin Tuna Fisheries: Management and Policy Implications

Alejandro CAPARRÓS, Abdelhakim HAMMOUDI and Tarik TAZDAÏT: On Coalition Formation with Heterogeneous Agents

Massimo GIOVANNINI, Margherita GRASSO, Alessandro LANZA and Matteo MANERA: Conditional Correlations in the Returns on Oil Companies Stock Prices and Their Determinants

Alessandro LANZA, Matteo MANERA and Michael MCALEER: Modelling Dynamic Conditional Correlations in WTI Oil Forward and Futures Returns

Margarita GENIUS and Elisabetta STRAZZERA: The Copula Approach to Sample Selection Modelling: An Application to the Recreational Value of Forests

Rob DELLINK and Ekkø van IERLAND: Pollution Abatement in the Netherlands: A Dynamic Applied General Equilibrium Assessment

Rosella LEVAGGI and Michele MORETTO: Investment in Hospital Care Technology under Different Purchasing Rules: A Real Option Approach

Salvador BARBERÀ and Matthew O. JACKSON: On the Weights of Nations: Assigning Voting Weights in a Heterogeneous Union

Álex ARENAS, Antonio CABRALES, Albert DÍAZ-GUILERA, Roger GUIMERÀ and Fernando VEGA-REDONDO: Optimal Information Transmission in Organizations: Search and Congestion

Francis BLOCH and Armando GOMES: Contracting with Externalities and Outside Options
<table>
<thead>
<tr>
<th>CTN</th>
<th>Date</th>
<th>Authors</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTN</td>
<td>79.2004</td>
<td>Rabah AMIR, Effrosyni DIAMANTOUDI and Licun XUE</td>
<td>Merger Performance under Uncertain Efficiency Gains</td>
</tr>
<tr>
<td>CTN</td>
<td>80.2004</td>
<td>Francis BLOCH and Matthew O. JACKSON</td>
<td>The Formation of Networks with Transfers among Players</td>
</tr>
<tr>
<td>CTN</td>
<td>81.2004</td>
<td>Daniel DIERMEIER, Hülya ERASLAN and Antonio MERLO</td>
<td>Bicameralism and Government Formation</td>
</tr>
</tbody>
</table>
## 2003 SERIES

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Editor</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLIM</td>
<td>Climate Change Modelling and Policy</td>
<td>Marzio Galeotti</td>
</tr>
<tr>
<td>GG</td>
<td>Global Governance</td>
<td>Carlo Carraro</td>
</tr>
<tr>
<td>SIEV</td>
<td>Sustainability Indicators and Environmental Valuation</td>
<td>Anna Alberini</td>
</tr>
<tr>
<td>NRM</td>
<td>Natural Resources Management</td>
<td>Carlo Giupponi</td>
</tr>
<tr>
<td>KNOW</td>
<td>Knowledge, Technology, Human Capital</td>
<td>Gianmarco Ottaviano</td>
</tr>
<tr>
<td>IEM</td>
<td>International Energy Markets</td>
<td>Anil Markandya</td>
</tr>
<tr>
<td>CSRM</td>
<td>Corporate Social Responsibility and Management</td>
<td>Sabina Ratti</td>
</tr>
<tr>
<td>PRIV</td>
<td>Privatisation, Regulation, Antitrust</td>
<td>Bernardo Bortolotti</td>
</tr>
<tr>
<td>ETA</td>
<td>Economic Theory and Applications</td>
<td>Carlo Carraro</td>
</tr>
<tr>
<td>CTN</td>
<td>Coalition Theory Network</td>
<td></td>
</tr>
</tbody>
</table>

## 2004 SERIES

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Editor</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCMP</td>
<td>Climate Change Modelling and Policy</td>
<td>Marzio Galeotti</td>
</tr>
<tr>
<td>GG</td>
<td>Global Governance</td>
<td>Carlo Carraro</td>
</tr>
<tr>
<td>SIEV</td>
<td>Sustainability Indicators and Environmental Valuation</td>
<td>Anna Alberini</td>
</tr>
<tr>
<td>NRM</td>
<td>Natural Resources Management</td>
<td>Carlo Giupponi</td>
</tr>
<tr>
<td>KTHC</td>
<td>Knowledge, Technology, Human Capital</td>
<td>Gianmarco Ottaviano</td>
</tr>
<tr>
<td>IEM</td>
<td>International Energy Markets</td>
<td>Anil Markandya</td>
</tr>
<tr>
<td>CSRM</td>
<td>Corporate Social Responsibility and Management</td>
<td>Sabina Ratti</td>
</tr>
<tr>
<td>PRA</td>
<td>Privatisation, Regulation, Antitrust</td>
<td>Bernardo Bortolotti</td>
</tr>
<tr>
<td>ETA</td>
<td>Economic Theory and Applications</td>
<td>Carlo Carraro</td>
</tr>
<tr>
<td>CTN</td>
<td>Coalition Theory Network</td>
<td></td>
</tr>
</tbody>
</table>