Essays on Political Economy

by

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A Dissertation Presented in Partial Fulfillment
of the Requirement for the Degree
Doctor of Philosophy

Approved June 2014 by the
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ARIZONA STATE UNIVERSITY

August 2014

ABSTRACT

This dissertation focuses on democracies governed by a Parliament. In such democracies, the executive branch consists of a subset of parties in the Parliament, called the Government. A key feature is that the Government is only indirectly determined by the voters' electoral decisions. This dissertation address how parliamentary characteristics and institutions influence the composition of the Government and government outcomes. The composition of the Government reflects the size and ideological make-up of the Government. Government outcomes reflect the length the Government survives and the policy consequences of the Government. The literature focuses on the former criterion. The view is that, in parliamentary democracies, longer Government duration should be associated with stability and better policies. The latter is important from the perspective of *directly* evaluating whether Governments make good or bad decisions from the perspective of voters. The first chapter of this dissertation develop a model of the government formation process, where parties care about and bargain over both policy and office benefits. The model generate predictions that matches important features of the data. The second chapter uses data from western European parliamentary democracies to estimate the parameters of the model in chapter one. The estimation results suggest that coalitions care about both ideology and office benefits, but more about office benefits. The third chapter studies which (existing) institutional environments lead to 'good' government outcomes. The results have a number of important implications for constitutional design.

To Jingxing, Yaping and Kun whose love, support and devotion made all my achievements possible.

ACKNOWLEDGEMENTS

This dissertation could not have been written without Amanda Friedenberg who not only served as my advisor but also encouraged and challenged me throughout my academic program. I would also like to express my gratitude to other dissertation committee members including Alejandro Manelli, Hector Chade and Dan Silverman. I thank Hulya Eraslan for sharing her data and program with me. For thoughtful comments and insight, I thank Michael Laver, Kenneth Benoit, Matthew Wiswall, Berthold Herrendorf, Daniel Diermeier, Kelly Bishop, Alvin Murphy, Pablo Schenone, Galina Vereshchagina, Edward Schlee, Alexander Bick, seminar and conference participants of Arizona State University, Carnegie Mellon University, Royal Holloway, Annual Meeting of American Political Science Association, Annual Meeting of Midwest Political Science Association and North American Summer Meeting of Econometric Society. All remaining errors are my own.

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Preface

Parliamentary democracies are an important system of democratic governance. They are used in Britain, Germany, Italy, Belgium, Netherlands, Denmark, Turkey, Australia, Canada, Japan, etc. In parliamentary democracies, the election determines the legislative branch, called the Parliament. However, it does not determine the executive branch. Instead, parties in Parliament attempt to form coalitions with one another. The output of the coalition formation process is a particular coalition called the Government. The Government is the executive branch. It is responsible to the Parliament and can be terminated if the Parliament loses confidence in the Government. But the government is not directly accountable to voters, since it is not directly elected by the voters. So, there may be a disconnect between policy position chosen by the Government and the voters' policy preferences.

My dissertation asks: How do institutions influence the composition of the Government and the associated government outcomes? It is important to study government outcomes because they directly affect voters. Here, we focus on two types of government outcomes. The first is political stability. It is measured by the duration of the government. This has been show to have important implications for economic outcomes. (See Alesina *et al.* (1996) and Barro (1991).) The second is government policy—whether the policy position is aligned with voters' policy preferences. So it directly impacts voter welfare.

These outcomes are determined by who is in the Government. So to understand government outcomes, we must also understand the composition of the Government. In particular, I focus on two aspects of the composition. The first is the size of the Government. It is the fraction of Parliamentary seats held by parties in the Government. The second is the ideological diversity of the Government. This measures whether parties in the Government have similar or dissimilar policy preferences.

Outline of the dissertation

Chapter 1 develop a model of the government formation process, where parties care about and bargain over both policy and office benefits. The equilibrium predictions match four important features observed in the data. First, ideologically dissimilar parties can form coalitions with one another. Second, minority or surplus Governments [1] can be formed. Third, delay can occur in equilibrium; that is, in equilibrium, it may take more than one attempt to form a Government. Fourth, government outcomes vary across both parliamentary characteristics and institutions.

Chapter 2 uses data from western European parliamentary democracies to estimate the parameters of the model developed in chapter one. In particular, it recovers how government duration and policy are determined in the government formation process. In addition, the estimation results suggest that parties care about both ideology and office benefits, but more about office benefits.

Chapter 3 studies which (existing) institutional environments lead to 'good' government outcomes. The results have a number of important implications for constitutional design. First, within parliamentary democracies, a stable government may comes with policies that are far afield from voters' policy preference. So it is critical to

[1] If there exists some party so that the government remains a majority coalition when that party is removed from the coalition, then the government is a surplus government.

evaluate a given institutional reform based on both the policy consequences and the duration of the Government. Second, there are important synergies between institutional rules. Whether adding a particular institution improves or worsens government outcomes often depends on the broader institutional environment.

Chapter 1

IDEOLOGY VS. PORK: A MODEL OF GOVERNMENT FORMATION

1.1 Introduction

In parliamentary democracies, the executive branch—the government is not directly elected by voters. Instead, it is the output of the negotiation process of parties in the parliament. There is a large literature on the prediction of the outcome of coalition formation process: Who will be included in the government? Is the government comprised of a minority of a majority of members in the parliament? Are the parties in the government ideologically adjacent to one another?

One standard argument in the literature is that parties should form minimum-winning and ideologically connected Governments. (See, e.g., von Neumann and Morgenstern (1953), Gamson (1961), Axelrod (1970) and Swaan (1973), Martin and Stevenson (2001, 2010), and Martin and Vanberg (2003), among many others.) The basic idea is that it is 'cheaper' to form minimum-winning and ideologically connected coalitions: they involve giving away fewer office benefits and making fewer ideological compromises. In practice, however, minority, majority and ideologically diverse governments are often formed. For instance, we often observe oversized majority governments in Germany, minority Governments in Denmark, and ideological diverse governments in Belgium.

The argument that parties should form minimum-winning and ideologically connected Governments misses two important tradeoffs. First, it misses the fact that the composition of the Government influences government duration and, in turn, influence the expected payoffs under different composition. Second, it misses the fact

that different parties value office benefits and policy differently; these differences give parties incentives to trade [1] . This chapter builds a model of government formation that takes these tradeoffs into account. The model shows that parliamentary characteristics and institutional environments influence whether minimum-winning and ideologically connected governments are equilibrium predictions.

In particular, the coalition formation process is modeled by a stochastic bargaining game where parties bargain over both office benefits and policy. The equilibrium predictions match four important features observed in the data. First, ideologically dissimilar parties can form coalitions with one another. Second, minority or surplus Governments can be formed. Third, delay can occur in equilibrium; that is, in equilibrium, it may take more than one attempt to form a Government. Fourth, government outcomes vary across both parliamentary characteristics and institutions.

1.2 The Model

There is a finite set of parties, N. Party $i \in N$ has a share of seats in the Parliament π_i. Let $\pi = (\pi_i)_{i \in N}$ be the distribution of seat shares. In what follows, Parties will bargain over ideology and office benefits. The ideological position of party $i \in N$ is $I_i \in \mathbb{R}$. The total level of office benefits is normalized to ϕ.

Refer to Figure 1.1. The game starts after the resignation of the incumbent government. (Before the game starts, the election already happened. So we are considering the government formation with an exogenous parliament.) There are four stages of the game. In the first stage, the head of the state chooses a formateur. In the second stage, the formateur chooses a proto-coalition. In the third stage, parties in the proto-coalition bargain and form a government. In the fourth stage,

[1] This feature also appears in the theoretical models of Jackson and Moselle (2002), Chen and Eraslan (2013a,b).

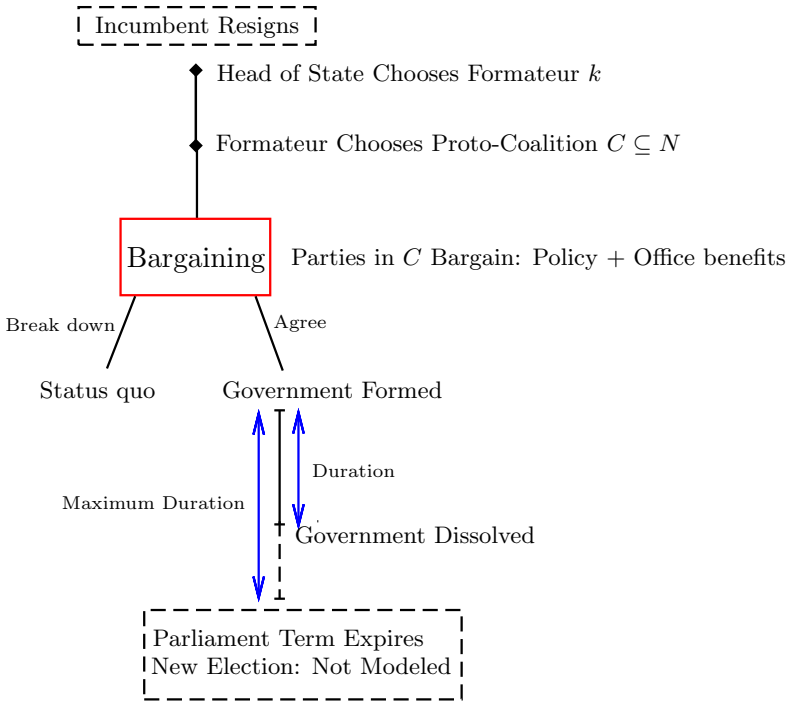

Figure 1.1 – Preview of Game

the government survives until it is dissolved. This is the government duration stage. We now describe the details of each of these stages.

Stage 1 Choosing the Formateur

The head of the state chooses a party to be the formateur, i.e., to form a government. The paper assumes that the head of the state is non-strategic and so the choice of the formateur is nonpartisan. This assumption follows Laver and Shepsle (1996), Baron (1991, 1993) and Diermeier *et al.* (2003).

So the formateur is randomly chosen. If there is a majority party in the parliament, the majority party will be the formateur; otherwise the probability of a party being the formateur will depend on the seat share of the party and whether the party contains the former prime minister. Party i is selected as the

formateur with probability

$$p_i(\pi, m) = \begin{cases} 1 & \text{if } \pi_i \geq 1/2 \\ \frac{\exp(\alpha_0 \pi_i + \alpha_1 m_i)}{\sum_j \exp(\alpha_0 \pi_j + \alpha_1 m_j)} & \text{if } \pi_j < 1/2 \text{ for all } j \in N \\ 0 & \text{if } \pi_j \geq 1/2 \text{ for some } j \neq i, \end{cases} \tag{1.1}$$

where $m = (m)_{i \in N}$ indicates which party contains the former prime minister, i.e., $m_i = 1$ if the party contains the former prime minister, and $m_i = 0$ otherwise.

Stage 2 Forming the Proto-Coalition

The formateur chooses a proto-coalition $C \subseteq N$, i.e., a subset of parties to potentially form a government. The formateur must include itself in the proto-coalition.

Stage 3 Bargaining within the Proto-coalition

Parties in the proto-coalition bargain over policy and office benefits. The timeline of the bargaining stage is as follows:

1. A state of the world is realized and revealed to every party.
2. The formateur chooses either to propose an allocation of ideology and office benefits or to pass on a proposal.
   (a) If the formateur proposes, parties in C sequentially vote to accept or reject the proposal.
   (b) If the proposal is unanimously accepted, a government is inaugurated and the bargaining stage ends.
3. If either no proposal is offered or a proposal is rejected:
   (a) A new state is realized.

(b) Some party $i \in C$ is randomly selected to either propose an allocation of ideology and office benefits or to pass on a proposal.

(c) Bargaining continues as above.

Note the use of terminology. The term proto-coalition reflects a subset of parties who will bargain with one another. The term government reflects a proto-coalition that has agreed to a particular allocation of ideology and office benefits.

Let us review two aspects of the bargaining stage. First, the state can be seen as summarizing idiosyncratic (economic or political) shocks that cause governments to be more or less stable [2] . We will see that the state will influence the government duration stage. In particular, the state $s \in S$ is drawn according an independent and identically distributed stochastic process with absolutely continuous CDF $F(\cdot)$.

Second, when an attempt to form a government fails, a new party in C is selected to make a proposal. The probability of party i being a proposer is

$$\tilde{p}_i(\pi, C) = \begin{cases} 1 & \text{if } \pi_i \geq 1/2 \\ \frac{\exp(\alpha_2 \pi_i)}{\sum_j \exp(\alpha_2 \pi_j)} & \text{if } \pi_j < 1/2 \text{ for all } j \in C \\ 0 & \text{if } \pi_j \geq 1/2 \text{ for some } j \neq i. \end{cases} \tag{1.2}$$

Note that if there is a majority party, the majority party is the proposer; otherwise the probability of a party being the proposer depends on the seat share of the party. When π and C are clear from the context, simply write $\tilde{p}_i$ for $\tilde{p}_i(\pi, C)$.

[2] For instance, there is a shock to euro which is thought to have good influences to the economy. Then parties expect the government will be more stable under the good economic environment and so they expect to enjoy office benefits and influence policy for a longer period of time.

Stage 4 Government Duration

The bargaining stage either results in a break down or the inauguration of a government. If the bargaining breaks down, office benefits are destroyed and the status quo policy remains in place. If a government is inaugurated, the allocation of office benefits and policy is implemented as the agreed upon proposal. The allocation is implemented for the entire duration of the government.

Government duration is a random variable. It depends on (a) the time horizon to the next election $\bar{T}$, (b) the institutional environment R, (c) the state of the world s when the government is formed, (d) the size of the governing coalition C, and (e) the ideological diversity of the governing coalition C. The *size* of C is measured by the sum of the seat shares of all the parties in coalition C, $\pi^C = \sum_{i \in C} \pi_i$. The *ideological diversity* of C is measured by the standard deviation of ideological positions of all the parties in coalition C, $\sigma_{I_i^C}$.

Thus, under proto-coalition C, the length of government duration $T^C \in [0, \bar{T}]$ is drawn from a distribution with (conditional) density $f(t^C | s, \bar{T}, R, \pi^C, \sigma_{I_i^C})$ on $[0, \bar{T}]$.

Given the formateur's choice of the coalition C, there are two types of bargaining outcomes. The first is an agreement outcome. This consists of (a) a time period τ^C when the parties agree to form a government and (b) an agreed upon allocation (I^C, x^C). Here $I^C \in \mathbb{R}$ is the policy position and $x^C = (x_i^C)_{i \in N}$ is the allocation of office benefits. The second is a disagreement outcome. This consists of an allocation $(I^Q, 0)$, where I^Q is the status quo policy and 0 represents the fact that office benefits are destroyed. We now describe the payoffs of these different outcomes.

Start with the agreement outcome. The payoff of the agreement outcome depends on an instantaneous payoff, government duration, and the time it takes to form a

government. We now expand on these elements. Under the agreement outcome (I^C, x^C), the instantaneous payoff of party $i \in N$ is

$$U_i(I^C, x^C) = x_i^C + b_i \exp\{-(I_i - I)^2\} + \psi_i^C,$$

where b_i indicates party i's preference for policy over office benefits and

$$\psi_i^C = \begin{cases} \varepsilon_i^C & \text{if } i \in C, \\ \eta_i^C & \text{if } i \notin C. \end{cases}$$

represents the taste shocks of party i when proto-coalition C forms a Government. These taste shocks may be different when party i is or is not in the coalition. Prior to the game, these shocks are known to all players, but they will not be observed by the econometrician.

Parties obtain the instantaneous payoffs so long as the government is in power. Write $d^C(s, \bar{T}, R, \pi^C, \sigma_{IC}) \equiv E[T^C | s, \bar{T}, R, \pi^C, \sigma_{IC}]$ for the conditional expectation of duration. When $\bar{T}, R, \pi^C$ and σ_{IC} are clear from the context simply write $d^C(s, \cdot)$, and when s is also clear form the context simply write $d^C(\cdot)$. So the expected payoff of party i at the time that parties reach an agreement is $d^C(\cdot)U_i(I^C, x^C)$. Note that parties do not discount the instantaneous payoffs [3] .

Parties have a distaste for bargaining. If an agreement is reached in period τ^C, the expected payoff of party i is $\delta^{\tau^c} d^C(\cdot)U_i(I^C, x^C)$, where $\delta \in (0, 1)$ represents the distaste for bargaining.

Now turn to the disagreement outcome. If the bargaining breaks down, the instantaneous payoff for party $i \in N$ is

$$U_i(I^Q, 0) = b_i \exp\{-(I_i - I^Q)^2\}.$$

[3]This assumption is for simplification.

1.3 Equilibrium Characterization

The bargaining model described above is a special case in the class of stochastic bargaining games studied by Merlo and Wilson (1995, 1997). It follows from Theorem 3 in Merlo and Wilson (1997) that there is an unique stationery subgame perfect equilibrium. There are three important feature of the equilibrium. These features are important for identification strategy in Chapter 2 [4] .

Proposition 1. *Government policy is determined by the* Government Policy Condition:

$$I^C = \frac{\sum_{i \in C} b_i \exp\{-(I_i - I^C)^2\} I_i}{\sum_{i \in C} b_i \exp\{-(I_i - I^C)^2\}}. \tag{1.3}$$

That is, the government policy position depends on the composition of the proto-coalition, but does not depend on when the proto-coalition reaches an agreement or who is chosen as the proposer in the bargaining process.

This feature arises from the following fact: given a proto-coalition C, each proposer will make a proposal (x^C, I^C), which maximizes the proto-coalition's payoff from government policy, $\sum_{i \in C} b_i \exp\{-(I_i - I^C)^2\}$. If not, the proposer would have a profitable deviation in which he maximizes the utility from ideology and keeps more office benefits. As a consequence, the government policy position only depends on the ideological positions and preference weights of parties in the Government.

Proposition 2. *On the equilibrium path, coalition C agrees in state s if and only if* $d^C(s, \cdot)u^C > y^C(\bar{T}, R, \pi^C, \sigma_{I^C})$, *where*
$u^C = \left[\phi + \sum_{i \in C} b_i \left(\exp\{-(I_i - I^C)^2\} - \exp\{-(I_i - I^Q)^2\}\right)\right]$,
and $y^C(\cdot)$ *solves*

$$y^C(\cdot) = \delta \int \max\left\{d^C(s', \cdot)u^C, y^C(\cdot)\right\} dF(s'), \tag{1.4}$$

[4] The proofs are in the appendix.

Refer to this as the *Bargaining-Cutoff Condition*. This feature arises from the following fact: a party agrees on a proposal at a state if and only if the expected payoff at that state is higher than his reservation utility. Thus, on the equilibrium path, coalition C agrees in state s if and only if the coalitions' expected payoff is higher than the total reservation utility of all parties in the coalition. Notice that parties face tradeoffs between the cost of delay and a higher expected payoff. On the one hand, parties have a distaste for bargaining, so they would want to reach an agreement as soon as possible. On the other hand, when a bad state is drawn, parties would want to wait for a better state associated with a longer duration and so a higher expected payoff. Thus, efficient delay can occur in equilibrium.

Proposition 3. *In any equilibrium, with probability 1 agreement will be reached within a finite amount of time. The expected equilibrium payoff to formateur k is*

$$W_k(C, \bar{T}, R, \pi^C, \sigma_{I^C}) = \frac{1-\delta(1-\tilde{p}_k)}{\delta} y^C(\cdot) + \varepsilon_k^C. \tag{1.5}$$

Refer to this as the *Formateur's Payoff Condition*. This feature arises from a payoff calculation. The formateur's expected payoff is increasing in the coalition's reservation utility $y^C(\cdot)$, which drives the formateur's desire for a larger 'pie'. It is also increasing in the likelihood of the formateur being a proposer $\tilde{p_k}$—the bargaining power of the formateur. This is because, the more bargaining power, the more share of the 'pie' would be distributed to the formateur. It is decreasing in the distaste of bargaining δ.

Let Δ_k be the collection of subsets in N that contain k. Then the equilibrium proto-coalition choice $C_k \in \Delta_k$ of formateur k is

$$C_k = \arg\max_{C \in \Delta_k} \frac{1-\delta(1-\tilde{p}_k)}{\delta} y^C(\cdot) + \varepsilon_k^C. \tag{1.6}$$

1.4 Predictions of the Model

There are four important features of the data that are captured by the equilibrium predictions of the model. Section 1.4.1 describes these features of the data. Section 1.4.2 discuss how they are delivered by the assumptions of the model.

1.4.1 Data

The sample consists of 200 governments in 7 Western European parliamentary democracies over the period of 1947-1999 [5] . These countries are Belgium, Denmark, Germany, Italy, The Netherlands, Norway and Sweden [6] . Now we describe four important features of the data.

First, we observe both ideologically diverse and tight-knit governments. Figure 1.2 is the histogram of the ideological diversity of the government. We can see that there are many ideologically tight-knit governments. In particular, Figure 1.3 shows that about 38% of the governments contains only a single party. About 25% of the governments consist of parties that are ideologically adjacent to one another. Nevertheless, about 38% of the governments are ideological disconnected, i.e., they consists of parties that are not ideologically adjacent.

Second, we observe minority, minimum winning and surplus governments. Figure 1.4 is the histogram of the size of the government. We can see that there are governments with less than half of the parliamentary seats. But, there are also some fairly large governments—with more than 60% of the parliamentary seats. In particular, Figure 1.5 shows that about 44% of the governments are minority governments. (A minority government controls strictly less than 50% of the parliamentary seats.) About 23% of the governments are surplus governments. (If there exists some party

[5]The data of government policy and government formation are not available after 1999.

[6]Data sources are DEM, Benoit *et al.* (2013) and Volkens *et al.* (2013).

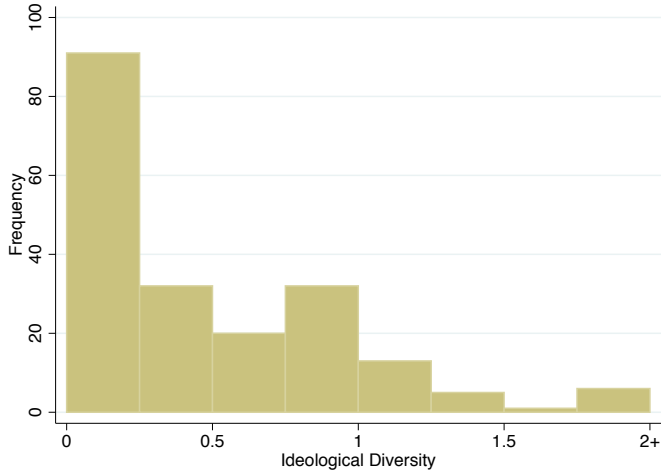

Figure 1.2 – Ideological Diversity of the Government

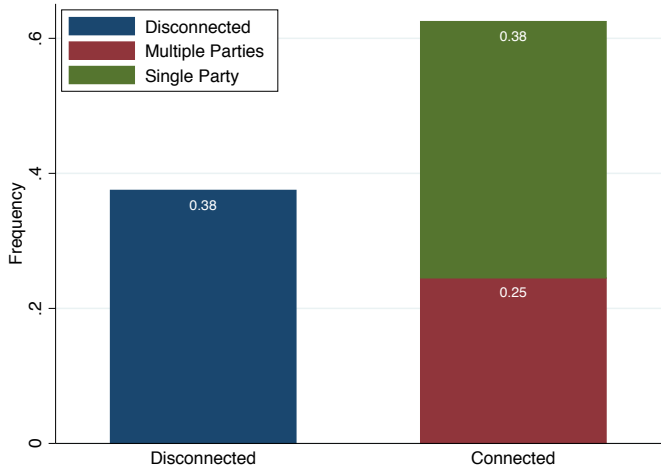

Figure 1.3 – Ideological Diversity: Types of the Government

so that the government remains a majority coalition when that party is removed from the coalition, then the government is a surplus government.) About 32% of the governments are minimum winning governments. (If removing any one of the parties from the coalition results in a minority coalition, then the government is a minimum winning government.)

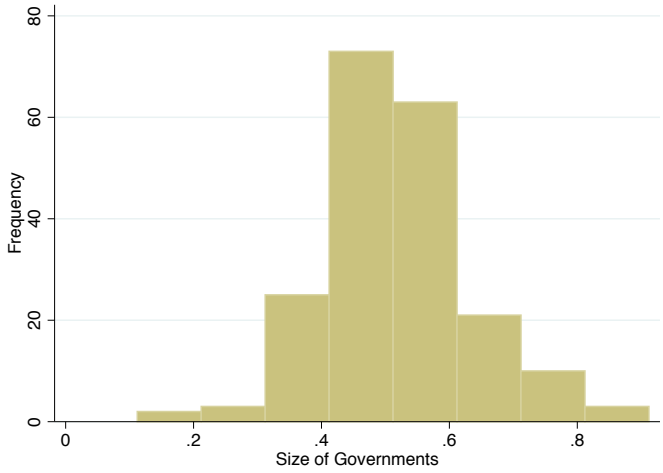

Figure 1.4 – Size of the Government

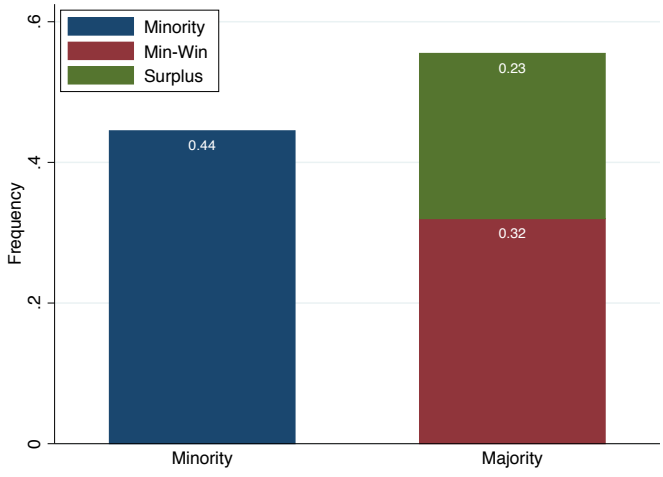

Figure 1.5 – Size: Types of the Government

Third, we observe government outcomes vary across countries. Figure 1.6 shows

mean duration of governments across countries. Figure 1.7 shows mean ideological losses of governments across countries. Ideological losses are measured by the gap between government policy and voters' policy preferences [7] . These countries differ in terms of both parliamentary characteristics and institutional environments. So, government outcomes appear to vary across both parliamentary characteristics and institutional environments.

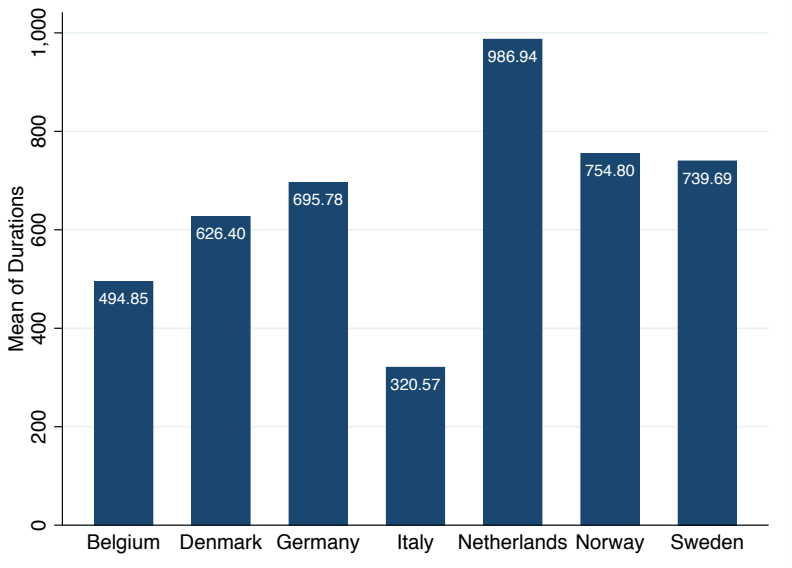

Figure 1.6 – Duration Across Countries

Finally, we have data on how parties negotiate to form a Government. Figure 1.8 is the histogram of the number of attempts it takes to form a government. Note that about 61% of all governments are formed in the first attempt and 97% of all governments are formed within 4 attempts. So, we observe both immediate agreements and delays in reaching agreements.

[7] Here we assume the parliament represents voters' policy preferences.

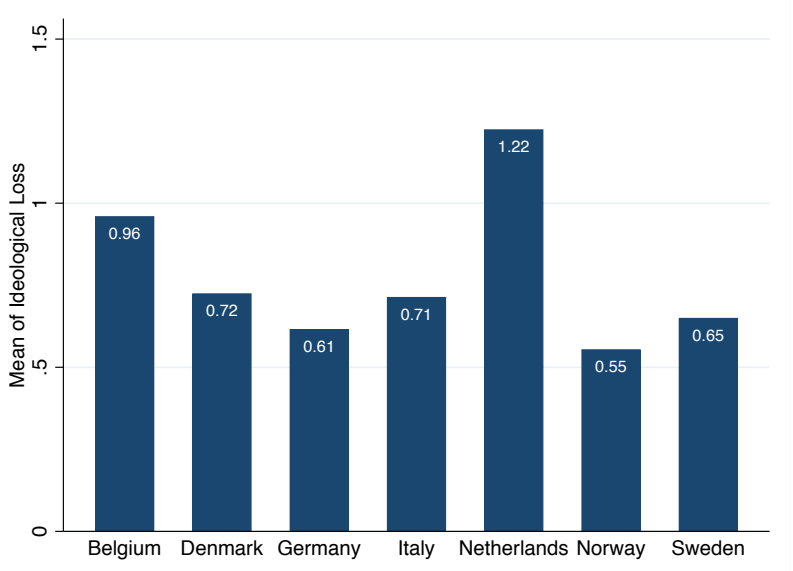

Figure 1.7 – Ideological Losses Across Countries

1.4.2 Discussion: From Model to Data

The first two features are about the composition of the government. As mentioned in Section 1.1, one standard argument in the literature is that parties should form minimum-winning and ideologically connected Governments. This is because it is 'cheaper' to form minimum-winning and ideologically connected coalitions: they involve giving away fewer office benefits and making fewer ideological compromises. Clearly, Section 1.4.1 shows that the prediction of this literature does not match the observed data: We do observe a fair number of minority, surplus and ideologically disconnected governments.

By contrast, the model in this chapter can generate these predictions. There are two independent reasons that this can occur. The first reason is that parties tradeoff ideology and office benefits differently. Thus, parties which place a higher value on office benefits over ideology may want to form a coalition with ideological distant parties who care less about office benefits. Parties which place a higher value on

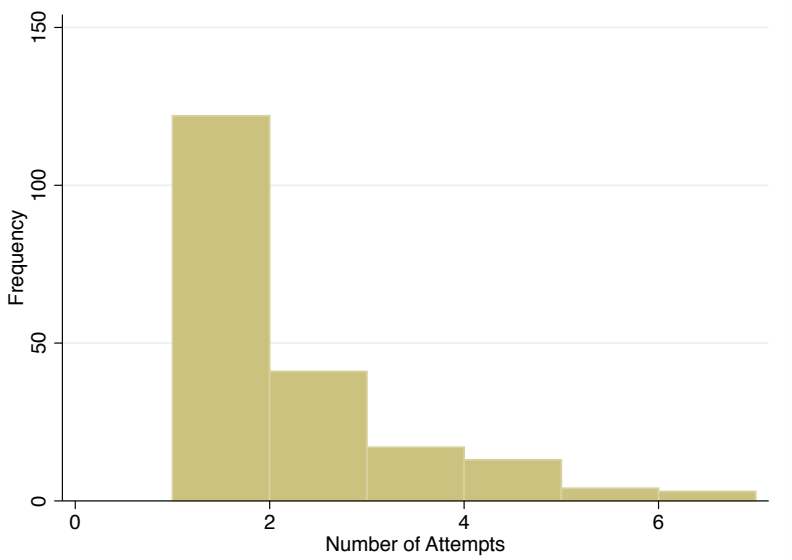

Figure 1.8 – The Number of Attempts to Form a Governments.

ideology over office benefits may want to form a coalition with ideologically adjacent parties, even if those parties are larger and require sharing more office benefits. The second reason is that duration depends on ideological diversity and size. The model does not make explicit assumptions on *how* ideology and size influence duration. If, in practice, size increases duration, parties may have incentive to form surplus governments (i.e., to increase the size of the pie). This may, in turn, require parties to form ideologically diverse governments.

The third feature is that government outcomes vary across both parliamentary characteristics and institutions. This comes from the assumption that duration depends on size, ideological diversity, and institutional rules. Different parliamentary characteristics—specifically, the seat share and the ideological composition of the parliament—affect size and ideological diversity and, in turn, they influence duration. This will influence the formateur's choice of coalition members and, thereby, influence government outcomes. Likewise, changing institutions also affects duration

and, in turn influences the composition of the government and government outcomes.

The fourth feature is that delay can occur in equilibrium. That is, it may take more than one attempt to form a government. This arises from the assumption that government duration depends on the state. If a bad state is drawn, parties expect duration to be short (i.e., a small pie) and, therefore, a lower expected payoff. Parties may (efficiently) want to delay agreement and wait for a better state. As a consequence, there is a trade off between the time it takes to form a government and expected longer duration.

1.5 Appendix

Proofs for Proposition 1 Notice that, if an agreement reached in any period, the proposer can extract all of the surplus above what it would take to get other parties to agree. Write $V_i(s)$ for the reservation utility for party i with state s. the Suppose party k is the proposer, the non-proposer $j \neq k$ will get

$$V_j(s) = \delta E_{s',\tilde{p}}(V_j). \tag{1.7}$$

Assume the proposer offers (x^C, I^C) in the agreement, then the agreement will offer the proposer k: an agreement will induce the proposer expected utility

$$V_k(s) = \max_{I^C} \left\{ d^C u^C - \delta E_{s',\tilde{p}} \left[\sum_{j \neq k} V_j \right], \delta E_{s',\tilde{p}} V_k \right\}. \tag{1.8}$$

Solve for optimal I^C gives the *Government Policy Condition* (Equation (1.3)):

$$I^C = \frac{\sum_{i \in C} b_i \exp\{-(I_i - I^C)^2\} I_i}{\sum_{i \in C} b_i \exp\{-(I_i - I^C)^2\}}.$$

Proofs for Proposition 2 Following the standard argument in the bargaining literature, in any equilibrium, with probability 1 agreement will be reached within a finite amount of time.

In any equilibrium, a party agrees on a proposal at a state if and only if the expected payoff at that state is higher than his reservation utility. Write $y \equiv \delta E_{s',\tilde{p}}\left(\sum_{i\in C} V_i\right)$ for the total reservation utility of parties in coalition C. Then on the equilibrium path, coalition C agrees in state s if and only if

$$d^C(s,\cdot)\left[\phi + \sum_{i\in C} b_i \exp\{-(I_i - I^C)^2\}\right] > y^C(\bar{T}, R, \pi^C, \sigma_{I^C}).$$

We now solve for $y^C(\cdot)$.

Given the optimal I^C, Equation (1.8) can be rewritten as

$$V_k(s) = \max\left\{d^C(s)u^C - y, 0\right\} + \delta[\tilde{p}_k E_s(V_k) + (1-\tilde{p}_k)E_s(V_k^-)] \tag{1.9}$$

where $u^C = \left[\phi + \sum_{i\in C} b_i\left(\exp\{-(I_i - I^C)^2\} - \exp\{-(I_i - I^Q)^2\}\right)\right]$, and $E_s(V_k^-)$ is the equilibrium payoff conditional on not being the proposer.

If the government forms, the proposer only offer the others their reservation value. Then whether the government is formed or not, non-proposers get

$$E_s(V_k^-) = \delta E_{s',\tilde{p}} V_k = \delta[\tilde{p}_k E_s(V_k) + (1-\tilde{p}_k)E_s(V_k^-)]$$

Then we can solve for $E_s(V_k^-)$ and get

$$E_s(V_k^-) = \frac{\delta\tilde{p}_k E_s(V_k)}{1-\delta(1-\tilde{p}_k)}$$

Substituting in (1.9), we get

$$V_k(s) = \max\left\{d^C(s)u^C - y, 0\right\} + \frac{\delta\tilde{p}_k E_s(V_k)}{1-\delta(1-\tilde{p}_k)}$$

Integrating over s, and solving for $E_s(V_k)$, we have

$$E_s[V_k] = \frac{1-\delta(1-\tilde{p}_k)}{1-\delta}\int \max\left\{d^C(s)u^C - y, 0\right\} dF(s) \tag{1.10}$$

Now, adding the payoffs of all $i \in C$ from (1.7) and (1.8), we get

$$\begin{aligned}\sum_{j\in C} V_j(s) &= \max\{d^C(s)u^C - y + \delta \sum_{i\in C} E_{s',\tilde{p}} V_i, \delta \sum_{i\in C} E_{s',\tilde{p}}[V_i]\} \\ &= \max\left\{d^C(s)u^C - y, 0\right\} \\ &= \max\left\{d^C(s)u^C, y\right\}.\end{aligned}$$

Then integrating both sides by $s', \tilde{p}$,

$$\sum_{i\in C} E_{s',\tilde{p}} V_i(s) = \int \max\left\{d^C(s)u^C, y\right\} dF(s)$$

Note that $y \equiv \delta E_{s',\tilde{p}} \left(\sum_{i\in C} V_i\right)$ then

$$\begin{aligned}y &= \delta \int \max\left\{d^C(s)u^C, y\right\} dF(s) \\ &= \delta \int \max\left\{d^C(s)u^C - y, 0\right\} dF(s) + \delta y.\end{aligned}$$

Rearranging this equation gives the *Bargaining-Cutoff Condition* (Equation (1.4)).

Proofs for Proposition 3 Rewrite Equation (1.4) to

$$\int \max\left\{d^C(s)u^C - y, 0\right\} dF(s) = \frac{1-\delta}{\delta} y.$$

Substitute it in (1.10), we get

$$E_s[V_k] = \frac{1 - \delta(1-\tilde{p}_k)}{\delta} y.$$

So the formateur's expected payoff of choosing C is

$$W_k(C, \bar{T}, R, \pi^C, \sigma^2_{IC}) = \frac{1 - \delta(1-\tilde{p}_k)}{\delta} y + \varepsilon^C_k.$$

Chapter 2

ESTIMATING THE MODEL OF GOVERNMENT FORMATION

2.1 Introduction

In practice, both parliamentary characteristics and institutional rules appear to have important implications for the composition of the Government and government outcomes. For instance, the June 1958 election in Belgium changed parliamentary characteristics. Prior to the election, the Government was Cabinet Van Acker IV, while post-election the Government was Cabinet Eysken II. These two governments differed in the composition of the Government and government outcomes. Cabinet Van Acker IV was larger and more ideologically diverse. It implemented more right wing policies and had a longer duration. Similarly, countries that systematically differ in institutional rules also differ systematically in the composition of Governments and government outcomes. In Denmark, minority Governments are often formed; in Germany, the norm is majority Governments. In Norway, Governments are ideologically tight-knit; in Belgium, Governments are more ideologically diverse. Governments in Italy are very short; in the Netherlands, Governments are stable and last long. (See Laver and Schofield (1990), Müller and Strøm (2000).)

This chapter uses data from western European parliamentary democracies to estimate the model in Chapter 1. In so doing, we can recover the coalition formation process. Thus, we can address questions as: How parties trade off ideology vs. office benefits? Do size and ideological diversity have direct effects on government duration or policy? How do the institutions directly influence government outcomes? Here, institutions concern a set of rules that influence how governments form and termi-

nate. This chapter studies four such institutional rules: an investiture vote, negative versus positive parliamentarism, a constructive vote of no confidence, and a fixed interelection period. Section 2.2.1 describes these rules.

There is a difficulty in empirically estimating the effect of parliamentary characteristics and institutions on the composition of the Government and government outcomes: The composition of the Government and government outcomes are simultaneously determined in equilibrium. When a party decides whom to include in its coalition, it anticipates the associated government outcomes. Thus, in equilibrium, the composition of the government depends on government outcomes. In particular, in the coalition formation process, there are tradeoffs amongst the distribution of office benefits, government policy and government duration: On the one hand, changing ideological diversity or the size of the coalition may result in a longer or shorter government duration; with a longer duration, coalition members can get more office perks and have a larger influence on government policy. On the other hand, changing ideological diversity or the size of the coalition may require sharing more office perks with other parties or making more compromises on government policy.

Likewise, in equilibrium, government outcomes also depend on the composition of the Government. Take ideological diversity as an example. Changing ideological diversity has direct effects on government policy. It also has direct effects on duration. (Warwick (1994) argues that ideologically dissimilar Governments may have a shorter duration because their members must make greater policy compromises. Strøm (1990) argues that ideological diversity may increases duration, because parties effectively exploit issue-by-issue differences between opposition parties.) There is also an important indirect effect, which works through an endogenous channel. Decreasing ideological diversity may force the coalition to decrease its size. In turn, decreasing size shortens government duration. (See e.g. Laver and Schofield (1990)

and Diermeier *et al.* (2003).) So decreasing ideological diversity may indirectly shorten duration.

To address the fact that the composition of the government and government outcomes are simultaneously determined, this chapter uses structural estimation. It adopts the model of chapter 1. It explicitly models the coalition formation process and has equilibrium predictions that match important features of the data. By estimating the primitives of the model (i.e., imposing equilibrium conditions on the data), it backs out the coalition formation process.

One interesting estimation result is that in equilibrium, coalitions care about both ideology and office benefits, but care more about office benefits than policy. The premise of this dissertation is that legislators are motivated by *both* ideology and office benefits. Each of these incentives has been discussed in the theoretical literature. (See Hotelling (1929), Wittman (1983), Calvert (1985), Callander (2008).) Though the estimation suggests that coalitions seem to be more motivated by office benefits, ideological component in the model still plays an important role to government outcomes. (See Chapter 3.)

Using the estimated model, this chapter also investigates the effect of size (respectively, ideological diversity) on duration holding fixed level of ideological diversity (respectively, size) and the institutions. For any set of institutions, increasing size appears to increase duration. Increasing ideological diversity may increase or decrease duration, depending on the set of institutions. Therefore, the joint effect of size and duration will depend on the institutions in place.

The results suggest systematic interactions between institutions and the effect of ideological diversity on duration. For instance, adding the investiture vote to the institutional environment appears to add a negative trend to the effect of ideological diversity on duration. That is, with the addition of the investiture vote to the in-

stitutional environment, there is a lower level of government duration for any given level of ideological diversity. This captures the direct effect of the investiture vote on duration.

2.2 Data

A significant component of the data in this paper is from DEM. DEM collects a large dataset on the process of government formation. The data consist of 7 Western European countries over the period of 1947-1999. It has information on the identity of the formateur, the composition of the proto-coalition, the number of attempts to form a government, the sequence of proposers (if the formateur does not succeed in forming a new government on the first attempt), government duration, the institutional features, the maximum time to the next election, the incumbent's party, and the seat distribution. Their data draws from several sources, most notably from *Keesings Record of World Events* (1944-2000).

Ideology does not enter DEM's model. As such, there is no ideological component in their dataset. By contrast, the main focus of this paper is about the ideological impact on government formation. This calls for three aspects of data that DEM does not have: (a) party ideology (a preference component); (b) government policy (an equilibrium outcome); and (c) the preference weight between office benefits and ideology (b_i).

The party ideological data is from Benoit *et al.* (2013). The government policy data is constructed from Volkens *et al.* (2013). Both policy and parties' ideological positions in the dataset are determined by text analysis. The government policy dataset is implemented following Lowe *et al.* (2011) [1] .

[1]Benoit *et al.* (2013) is implemented following Lowe *et al.* (2011).

Estimating the preference weight for each party in the model (i.e., b_i) uses the Experts Survey dataset of Laver and Hunt (1992). This dataset asks experts in each country of the sample to evaluate how parties within their country are willing to trade off office benefits vs. policy. There will be two difficulties in using this dataset to estimate the preference weights. One difficulty is a scaling problem, and the second difficulty is a missing data issue. These difficulties and solutions are discussed in Section 2.4.1.

The sample consists of 200 governments in 7 Western European countries over the period 1947-1992 [2] . The countries are Belgium (34 governments), Denmark (30 governments), Germany (23 governments), Italy (46 governments), Netherlands (16 governments), Norway (25 governments), and Sweden (26 governments). All the countries have been parliamentary democracies since World War II and elect their parliament according to proportional representation.

An observation is identified with a government. It is defined by the identity of the formateur party (k), the composition of the proto-coalition (C_k), the number of attempts to form the government (τ^{C_k}), the sequence of proposers if the formateur does not succeed in forming the government at the first attempt ($l_2, \ldots, l_{\tau^{C_k}}$), the policy announced by the formed government (I^{C_k}), and the number of days that the government survives (t^{C_k}). For each government in the sample, we will also observe a vector of constitutional rules (R), the time horizon to the next scheduled election ($\bar{T}$), the set of parties in the parliament (N), the vector of party seat shares (π), the vector of party ideological positions ($(I_i)_{i \in N}$), and the party that contains the former prime minister (k_{-1}).

Figures 2.1-2.6 present an overview of the aggregate features of the data. Figure 2.1 is the histogram of formateur size (i.e. formateur seat share). Note that, in about

[2] The sample in DEM consists of 255 governments.

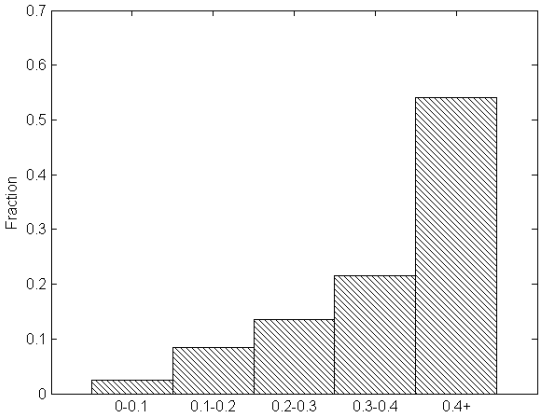

Figure 2.1 – Histogram of Formateur Seat Share

10% of all governments, the formateur controls an absolute majority of the parliamentary seats. When the formateur controls less than half of the parliamentary seats, there is a positive correlation between a party's size and its recognition probability. Figure 2.2 shows the histogram of the number of attempts to form a government. Note that about 61% of all governments are formed in the first attempt and 97% of all governments are formed within 4 attempts. Figure 2.3 shows the histogram of government duration. About 36% of all governments last less than one year and about 20% of all governments last to their maximum potential duration [3] . Figure 2.4 shows the histogram of government size. About 81% of all governments control between 40% and 60% of the parliamentary seats. Only about 5% of all governments control either less than 20% or more than 80% of the parliamentary seats.

Figure 2.5 shows the histogram of government ideology. Figure 2.6 shows the histogram of ideological diversity within a government. This is measured by the standard deviation of party ideology within a government. The levels of the government ideology and ideological diversity are not meaningful. Rather, they are presented to illustrate that there is variation in government ideology and ideological diversity.

[3]Note that this histogram does not reflect the maximum potential duration.

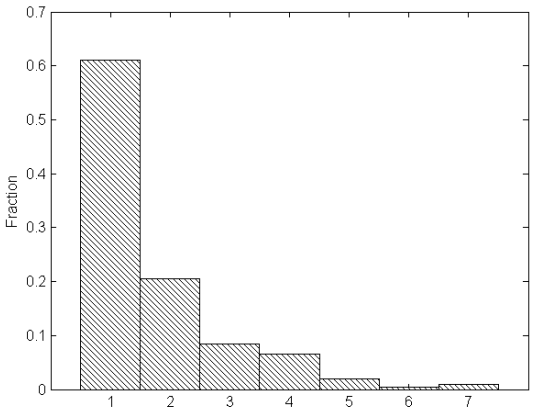

Figure 2.2 – Histogram of Negotiation Rounds

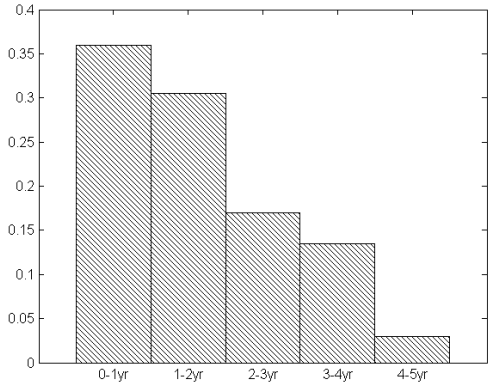

Figure 2.3 – Histogram of Government Duration

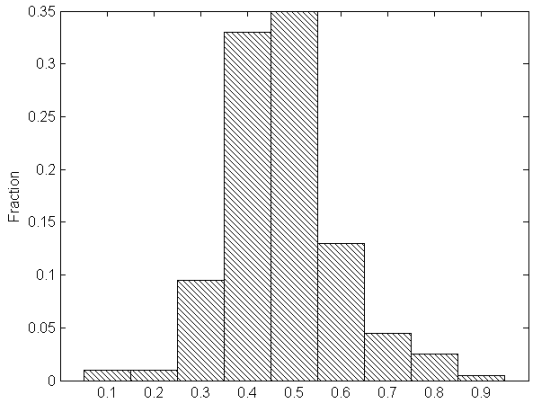

Figure 2.4 – Histogram of Government Size

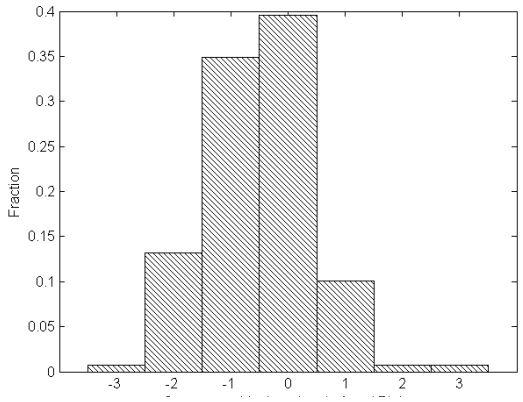

Figure 2.5 – Histogram of Government Policy Positions

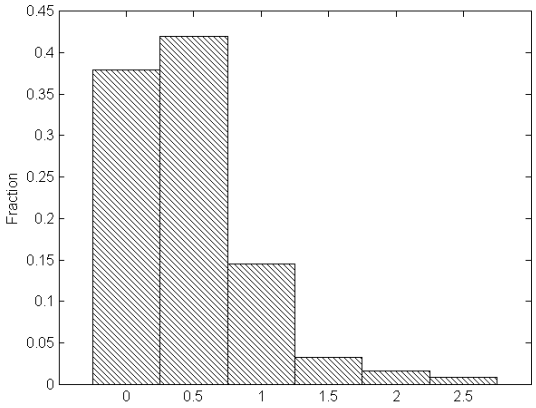

Figure 2.6 – Histogram of Party Ideological Diversity

The descriptive statistics of the variables are reported in Table 2.1. Here MINORITY is a dummy variable that equals to 1 if and only if the government is a minority coalition (i.e., it controls strictly less than 50% of the parliamentary seats). MAJORITY is a dummy variable that equals to 1 if and only if the government is a majority coalition (i.e, it controls at least 50% of the parliamentary seats). MINWIN is a dummy variable that equals to 1 if and only if the government is a minimum winning majority coalition (i.e., if removing any one of the parties from the coalition results in a minority coalition). SURPLUS is a dummy variable that equals to 1 if and only if the government is a surplus majority coalition (i.e., if there exists some party

so that the government remains a majority coalition when that party is removed from the coalition). Note that 44% of all governments in the sample are minority governments, 33% are minimum winning coalitions, and 23% are surplus coalitions. Minority governments are on average less stable than majority governments. That is, the mean government duration of minority governments (512 days) is smaller than that of majority governments (673 days). Moreover, minimum winning governments are on average more stable than surplus governments. That is, the mean government duration of minimum winning governments (808 days) is larger than that of surplus governments (488 days).

Tables 2.2-2.4 illustrate that the characteristics of governments vary across countries. Table 2.2 reports the average number of formation attempts, the average government duration, the average size of the government, and the average ideological position of the government. Table 2.3 reports the distribution of minority, minimum winning, and surplus governments. Table 2.4 reports the average standard deviation of party ideology. Note that the average ideological position of the government and the average standard deviation of party ideology are not meaningful; what is important is the fact that there is variation across countries.

Variable	*Mean*	*Standard Deviation*	*Minimum*	*Maximum*
Number of Attempts	1.74	1.18	1.00	7.00
Duration	601.29	429.75	7.00	1637.00
Time to Next Election	1188.40	391.62	133.00	1841.00
Number of Parties	5.95	1.97	3.00	12.00
Size of Coalition (%)	52.12	11.88	11.20	90.10
MINORITY	0.44	0.50	0.00	1.00
MAJORITY	0.56	0.50	0.00	1.00
MINWIN	0.33	0.47	0.00	1.00
SURPLUS	0.23	0.43	0.00	1.00

Table 2.1 – Descriptive Statistics

Country	*Mean Attempts*	*Mean Duration*	*Mean Size* (%)	*Policy: Log Left Right*
Belgium	2.41	494.85	60.66	38.28
Denmark	1.77	626.40	40.66	39.72
Germany	1.09	695.78	57.49	17.71
Italy	1.85	320.57	51.46	19.27
Netherlands	2.75	986.94	66.31	61.95
Norway	1.08	754.80	46.65	66.92
Sweden	1.19	739.69	47.11	22.51
Average	1.74	601.29	52.12	35.18

Table 2.2 – Government Formation and Duration

Country	% *Minority*	% *Minimum Winning*	(%) *Surplus*
Belgium	17.65	47.06	35.29
Denmark	86.67	13.33	0.00
Germany	13.04	69.57	17.39
Italy	45.65	6.52	47.83
Netherlands	0.00	43.75	56.25
Norway	64.00	36.00	0.00
Sweden	65.39	34.62	0.00
Average	44.50	32.00	23.50

Table 2.3 – Distribution of Government Size Category

Country	*Mean Std of Ideology*
Belgium	0.72
Denmark	0.49
Germany	0.40
Italy	0.47
Netherlands	0.61
Norway	0.15
Sweden	0.23
Average	0.45

Table 2.4 – Distribution of Ideological Diversity

2.2.1 Institutions

This paper focuses on four institutional rules. Countries in the sample vary across these rules. (See Table 2.5.) We now describe the four institutional rules.

The first institutional rule is an investiture vote. If there is an investiture vote, the government needs a vote by parliament to legally assume office. The dummy variable INVEST indicates whether or not the government requires an investiture vote. In particular, INVEST=Y (N) if and only if the government requires (does not require) an investiture vote.

The second institutional rule pertains to whether the government requires positive parliamentarism or whether negative parliamentarism is sufficient. Positive parliamentarism is a requirement that the government obtains continued explicit support of a parliamentary majority to remain in power. Under negative parliamentarism, the lack of opposition by a parliamentary majority is sufficient. The dummy variable NEG indicates whether negative parliamentarism is sufficient for the government to remain in power. In particular, PARL=+ if positive parliamentarism is required; PARL=- if negative parliamentarism is sufficient.

The third institutional rule is a constructive vote of no confidence. If there is a constructive vote of no confidence, a government can be voted out of office only if there is an immediate alternative replacement government on the table. The dummy variable CVOTE indicates whether a constructive vote of no confidence is required. In particular, CCONF=Y (N) if and only if there is (not) a constructive vote of no confidence.

The fourth institutional rule is a fixed interelection period. If there is a fixed interelection period, then elections must be held at predetermined intervals. In countries without a fixed interelection period, the parliament can be dissolved before the

expiration of the parliamentary term and it can start a new term by calling early elections. The dummy variable FIX indicates whether there is a fixed pre-election period. In particular, FIX=Y (N) if and only if there is (not) a fixed interelection period.

Country	*INVEST*	*PARL*	*CVOTE*	*FIX*
Belgium	Y	+	N	N
Denmark	N	-	N	N
Germany	N	+	Y	N
Italy	Y	+	N	N
Netherlands	N	+	N	N
Norway	N	-	N	Y
Sweden	N	-	N	Y

Table 2.5 – Institutional Environment across Countries

2.3 Model

This chapter adopts the model of government formation in Chapter 1. An outcome of the game consists of a formateur, a proto-coalition, the number of attempts to form a government, a sequence of proposers, and either (a) an agreed upon policy and distribution of office benefits or (b) disagreement amongst parties in the proto-coalition. Each of these features will be observed in the data, with one exception: the distribution of office benefits. (See Section 2.2.) Traditionally, office benefits is seen as a distribution of cabinet seats. (See, e.g., Ansolabehere *et al.* (2005).) But, office benefits can also reflect other benefits to office, e.g., monetary side payments. Such benefits are often unobserved. We will back out the total level of office benefits from the data.

Three conditions are critical to the econometric specification. The first condition is the *Government Policy Condition*. In equilibrium, each proposer is going to maximize the coalition's expected payoff. As a consequence, government policy is determined by Equation 1.3:

$$I^C = \frac{\sum_{i \in C} b_i \exp\{-(I_i - I^C)^2\} I_i}{\sum_{i \in C} b_i \exp\{-(I_i - I^C)^2\}}.$$

The second condition is the *Bargaining Cutoff Condition*. On the equilibrium path, coalition agrees if and only if coalition's expected payoff is greater than its reservation utility. In this chapter, we normalize each party's payoff from the disagreement outcome to be 0 [4] . So coalition C agrees in state s if and only if $d^C(s,\cdot)u^C > y^C(\bar{T}, R, \pi^C, \sigma_{I^C})$, where $u^C = \phi + \sum_{i \in C} b_i \left(\exp\{-(I_i - I^C)^2\}\right)$, and $y^C(\cdot)$ solves

$$y^C(\cdot) = \delta \int \max\left\{d^C(s',\cdot)u^C, y^C(\cdot)\right\} dF(s'), \tag{2.1}$$

The third condition is the *Formateur's Payoff Condition*. The formateur chooses a coalition to maximize its expected payoff. The expected equilibrium payoff to formateur k is described by Equation 1.5:

$$W_k(C, \bar{T}, R, \pi^C, \sigma_{I^C}) = \frac{1 - \delta(1 - \tilde{p}_k)}{\delta} y^C(\cdot) + \varepsilon_k^C.$$

2.4 Econometric Specification

This paper uses a two-step estimation process to identify the model parameters. The first step estimates preference weights, i.e. the b_i's, up to a scale. The second step uses the results of first step to estimate the scale and the model.

[4]The key assumption is that parties do not have differential payoffs from disagreement. This assumption does not change the bargaining outcome within any given proto-coalition, but can change the formateur's choice of coalition.

2.4.1 Estimation of the Preference Weights

As described in Section 2.2, this paper uses Laver and Hunt's (1992) dataset to estimate the preference weights. The dataset gives expert survey estimates for party i, written $\hat{b}_i$. There are two difficulties in using $\hat{b}_i$ as the data for preference weights. The first difficulty is a scaling problem. The $\hat{b}_i$'s are informative about the relative tradeoffs (between office benefits and ideology) across parties, but they are not informative about levels of the tradeoffs. In particular, any scale can be used as preference weights. Estimating the model requires identifying the scale that fits the model. The scale is captured by ϕ. The second difficulty is a missing data problem. Laver and Hunt (1992) does not provide estimates of preference weights for all parties in the sample. So, the missing preference weights need to be recovered.

To recover the missing preference weights, view b_i as a function of $\hat{b}_i$. In particular, take $b_i = \exp(\beta\hat{b}_i)$. The parameter β reflects a relationship between b_i and $\hat{b}_i$: If $\beta > 0$, there is a positive correlation between b_i and $\hat{b}_i$; the data will tell us there is such a positive correlation [5] . The paper estimates the parameter β, within Laver and Hunt's (1992) dataset. It then uses the estimated β's to recover the missing b_i's. Now turn to how this is implemented.

To estimate β, use the equilibrium *Government Policy Condition* (Equation (1.3)). Given a proto-coalition C, we know

$$I^C = \frac{\sum_{i\in C} b_i \exp\{-(I_i - I^C)^2\} I_i}{\sum_{i\in C} b_i \exp\{-(I_i - I^C)^2\}} + \nu Q + \xi.$$

Here, Q is a vector of control variables that are orthogonal to coalition formation process but correlated with government policy, i.e. GDP, a year dummy, and a decade dummy. The variable ξ is a structural error that captures other unobserved factors orthogonal to coalition formation process but correlated with government

[5]The exponential function is a common choice in the literature.

policy. Since $b_i = \exp(\beta \hat{b_i})$, the above equation can be rewritten as

$$I^C = \frac{\sum_{i \in C} \exp\{\beta \hat{b_i} - (I_i - I^C)^2\} I_i}{\sum_{i \in C} \exp\{\beta \hat{b_i} - (I_i - I^C)^2\}} + \nu Q + \xi. \tag{2.2}$$

We can observe I^C, I_i, and $\hat{b}_i$ in data. So, β and ν can be estimated by solving the following problem:

$$\min_{(\beta,\nu)} \xi = \min_{(\beta,\nu)} \left\{ I^C - \frac{\sum_{i \in C} \exp\{\beta \hat{b_i} - (I_i - I^C)^2\} I_i}{\sum_{i \in C} \exp\{\beta \hat{b_i} - (I_i - I^C)^2\}} + \nu Q \right\}.$$

Notice that β can only be identified up to the scale ϕ. So for all the parties in the sample of Laver and Hunt (1992), we can identify $b_i = f(\hat{b}_i; \beta)$ up to the scale ϕ.

We use this to recover the missing preference weights (i.e., the b_i's for the parties that are not in the sample of Laver and Hunt (1992)). The key assumption is that the preference weights b_i's are constant over time. With this, fix a proto-coalition C and refer to Equation (2.2). If we can observe $\hat{b}_j$ for all but one party j' in the proto-coalition, then we can infer b_i up to the scale ϕ. Since b_i is constant over time, the dataset of Laver and Hunt (1992) is rich enough to back out all the missing b_i's up to the scale ϕ.

So far we have identified all the b_i's up to the scale ϕ. The next step of the estimation will identify ϕ (along with other model parameters) using maximum likelihood estimation.

2.4.2 Estimation of the Model

For the second step of the estimation, this paper adopts a specification similar to DEM. This uses maximum likelihood estimation to estimate the model parameters. Recall, an observation is defined as a vector of $(k, C_k, \tau^{C_k}, l_2 \ldots l_{\tau^{C_k}}, t_k)$. For each observation in the sample, the exogenous characteristics are described as a vector of $Z = (R, \bar{T}, k_{-1}, (I_i)_{i \in N}, \pi)$.

Write θ for the model parameters. (This section will later specify what those parameters are.) Of course, the likelihood function will depend on the model parameters. The contribution to the likelihood function of each observation m is the probability of observing the vector of (endogenous) events $(k, C_k, \tau^{C_k}, l_2 \ldots l_{\tau^{C_k}}, t_k)_m$ conditional on the vector of (exogenous) characteristics $Z_m = (\bar{T}, R, N, \pi, k_{-1}, I)_m$. Write the likelihood function as

$$L_m \equiv \Pr\left((k, C_k, \tau^{C_k}, l_2 \ldots l_{\tau C_k}, t^{C_k})_m | Z_m; \theta\right).$$

The above equation can be rewritten as

$$\begin{aligned} L_m = \Pr(k|Z;\theta) \times \Pr(C_k|k,Z;\theta) \times \Pr\left(\tau^{C_k}|k,C_k,Z;\theta\right) \\ \times \Pr\left(l_2 \ldots l_{\tau^{C_k}}|k,C_k,\tau^{C_k},Z;\theta\right) \times \Pr\left(t^{C_k}|l_2 \ldots l_{\tau C_k},\tau^{C_k},k,C_k,Z;\theta\right), \end{aligned}$$

We now discuss how to calculate these components.

Note that Equation (1.1) gives the probability of party k being formateur, i.e.,

$$\Pr(k|Z;\theta) = p_k\left(\pi, k_{-1}; \alpha_0, \alpha_1\right). \tag{2.3}$$

Similarly, Equation (1.2) gives the probability of parties $l_2, \ldots, l_\tau$ being proposers when the first attempt to form a government fails in proto-coalition C_k, i.e.,

$$\Pr\left(l_2 \ldots l_{\tau^{C_k}}|k,C_k,\tau^{C_k},Z;\theta\right) = \Pi_{j=2}^{\tau_k^C} \tilde{p}_{l_j}\left(\pi, C_k; \alpha_2\right), \tag{2.4}$$

Now turn to compute $\Pr(C_k|k,Z;\theta)$. Consider the decision problem faced by the formateur party k. For each possible coalition $C \in \Delta_k$, party k can compute its expected equilibrium payoff if C is chosen as the proto-coalition. The formateur's expected payoff is given by *Formateur's Payoff Condition* (Equation (1.5)) and depends on the expected outcome of the bargaining process as well as the formateur's tastes for its coalition members, ε_k^C. From the perspective of the formateur that knows its own

taste, the optimal coalition choice is deterministic. However, from the perspective of the econometrician, ε_k^C is a random variable. This implies that the expected payoff $W_k(C, \bar{T}, R, \pi^C, \sigma_{IC})$ is also a random variable. Following Rust (1987), McFadden (1973), Diermeier *et al.* (2003) and many others, this paper assumes the following: for each k, the random variable ε_k^C is independent and identically distributed according to a type 1 extreme value distribution with standard deviation ρ [6] . Thus, the probability that formateur k chooses a particular proto-coalition $C_k \in \Delta_k$ to form a government is

$$\begin{aligned}\Pr(C_k|k, Z; \theta) &= \Pr\left(W_k(C_k, \bar{T}, R, \pi^{C_k}, \sigma_{IC_k}) > W_k(C, \bar{T}, R, \pi^C, \sigma_{IC}), \forall C \in \Delta_k\right) \\ &= \frac{\exp\left(\frac{[1-\delta(1-\tilde{p}_k(\pi,C_k)]y^C}{\delta\rho}\right)}{\sum_{C\in\Delta_k}\exp\left(\frac{[1-\delta(1-\tilde{p}_k(\pi,C)]y^C}{\delta\rho}\right)}\end{aligned}$$

Now turn to compute $\Pr\left(\tau^{C_k}|k, C_k, Z; \theta\right)$ and $\Pr\left(t^{C_k}|l_2 \ldots l_{\tau C_k}, \tau^{C_k}, k, C_k, Z; \theta\right)$: The former is the conditional probability that proto-coalition C_k takes τ^{C_k} attempts to form a government. The latter is the conditional probability that the government lasts t^{C_k} days.

For simplicity, write $u^{C_k} \equiv \sum_{i\in C_k} U_i(I^{C_k}, x^{C_k})$ for the total instantaneous utility . Then the conditional probability that proto-coalition C_k takes τ^{C_k} attempts to form a government is

$$\Pr\left(\tau^{C_k}|k, C_k, Z; \theta\right) = \left[\Pr\left(u^{C_k}d^{C_k} < y^{C_k}\right)\right]^{\tau-1}\Pr\left(u^{C_k}d^{C_k} \geq y^{C_k}\right) \tag{2.5}$$

The conditional probability that the government last t^{C_k} days following τ^{C_k} attempts is

$$\Pr\left(t^{C_k}|l_2 \ldots l_{\tau C_k}, \tau^{C_k}, k, C_k, Z; \theta\right) = \Pr\left(t|u^{C_k}d^{C_k} \geq y^{C_k}\right) \tag{2.6}$$

Note, computing the above two probabilities requires computing u^{C_k}, d^{C_k} and y^{C_k}. Now turn to how these three components are computed.

[6] This is the standard assumption in the literature to model choice probability.

First, recall from Section 2.4.1, u^{C_k} can be identified up to the scale ϕ. Now turn to y^{C_k} and d^{C_k}. From the perspective of the parties that observe the state, the sequence of events in the bargaining process is deterministic. The only uncertainty comes from actual duration following an agreement (i.e., T^{C_k}). So T^{C_k} is a random variable. However, the econometrician does not observe the state s. Thus, from the perspective of the econometrician, expected duration $d^{C_k}(\cdot, \bar{T}, R, \pi^{C_k}, \sigma_{I^{C_k}}) : S \to [0, \bar{T}]$ is also a random variable.

Let $F_d(d^{C_k}|\bar{T}, R, \pi^{C_k}, \sigma_{I^{C_k}})$ be the conditional distribution of *expected* duration. Write $f_d(\cdot|\cdot)$ for the conditional density; the conditional density has support $[0, \bar{d}]$, where $\bar{d} < \bar{T}$ is the upper bound on the expectation of government duration. Let $F_T(t^{C_k}|d^{C_k}; \bar{T}, R, \pi^{C_k}, \sigma_{I^{C_k}})$ be the conditional distribution of the *actual* duration. Write $f_T(\cdot|\cdot)$ the conditional density; the conditional density has support $[0, \bar{T}]$. In addition, $F_T(\cdot|\cdot)$ satisfies the restriction $E\left[T^{C_k} \left| d^{C_k}; \bar{T}, R, \pi^{C_k}, \sigma_{I^{C_k}}\right.\right] = d^{C_k}$. There are specific assumptions on $F_d(\cdot|\cdot)$ and $F_T(\cdot|\cdot)$ that will be described later.

Now from the perspective of econometrician, $y^{C_k}(\cdot)$ solves

$$y^{C_k} = \delta \int \max\left\{u^{C_k} d^{C_k}, y^{C_k}\right\} dF_d(d^{C_k}|\bar{T}, R, \pi^{C_k}, \sigma_{I^{C_k}})$$

This uses *Bargaining-Cutoff Condition* (Equation (2.1)). With this, Equations (2.5) and (2.6) can be written as

$$\Pr\left(\tau^{C_k}|k, C_k, Z; \theta\right) = \left[F_d\left(\frac{y^{C_k}}{u^{C_k}}|\bar{T}, R, \pi^{C_k}, \sigma_{I^{C_k}})\right)\right]^{\tau-1}\left[1 - F_d\left(\frac{y^{C_k}}{u^{C_k}}|\bar{T}, R, \pi^{C_k}, \sigma_{I^{C_k}})\right)\right]$$

and

$$\Pr\left(t^{C_k}|l_2 \ldots l_{\tau C_k}, \tau^{C_k}, k, C_k, Z; \theta\right) = \frac{\int_{y^{C_k}/u^{C_k}}^{\bar{d}} f_T(t^{C_k}|d^{C_k}; \bar{T}, R, \pi^{C_k}, \sigma_{I^{C_k}}) dF_d(d^{C_k}|\bar{T}, R, \pi^{C_k}, \sigma_{I^{C_k}})}{1 - F_d(\frac{y^{C_k}}{u^{C_k}}|\bar{T}, R, \pi^{C_k}, \sigma_{I^{C_k}})}$$

Following Merlo (1997) and Diermeier *et al.* (2003), assume $F_d(\cdot\,|\cdot)$ and $F_T\left(\cdot\,|\cdot\right)$ belong to the family of beta distributions [7] . In particular, let

$$f_d\left(d^C\left|C,\bar{T},R,\pi^C,\sigma_{I^C}\right.\right)=\gamma\left(\bar{T},R,\pi^C,\sigma_{I^C}\right)\left[\frac{\left[d^C\right]^{\gamma\left(,\bar{T},R,\pi^C,\sigma_{I^C}\right)-1}}{\left[\bar{d}\left(\bar{T},R\right)\right]^{\gamma\left(C,\bar{T},R,\pi^C,\sigma_{I^C}\right)}}\right]$$

where $d^C\in\left[0,\bar{d}\left[\bar{T},R\right]\right]$,

$$\begin{aligned}\gamma(\bar{T},R,\pi^C,\sigma_{I^C}^2)=&\exp\{(\gamma_0+\gamma_1\pi^C+\gamma_2{\pi^C}^2)MINOR\\&+(\gamma_3+\gamma_4\pi^C+\gamma_5{\pi^C}^2)MAJOR+\gamma_6\sigma_{I^C}+\gamma_7{\sigma_{I^C}}^2\\&+(\gamma_8\text{INVEST}+\gamma_9NEG+\gamma_{10}\text{CCONF})\pi^C\\&+(\gamma_{11}\text{INVEST}+\gamma_{12}NEG+\gamma_{13}\text{CCONF})\sigma_{I^C}\\&+(\gamma_{14}FIXEL+\gamma_{15}(1-\text{FIXEL})\bar{T})\}\end{aligned}$$

and

$$\bar{d}\left(\bar{T},R\right)=\begin{cases}0.9\bar{T} & \text{if FIXEL}=1,\\ \frac{\exp(\lambda_0+\lambda_1\text{INVEST})}{1+\exp(\lambda_0+\lambda_1\text{INVEST})}0.9\bar{T} & \text{if FIXEL}=0.\end{cases}$$

Furthermore, let

$$\begin{aligned}f_T(t^C|d^C;\bar{T},R,\pi^C,\sigma_{I^C})=&\frac{1}{B\left(\frac{\zeta\left(C,\bar{T},R,\pi^C,\sigma_{I^C}\right)d^C}{\bar{T}-d^C},\zeta\left(C,\bar{T},R,\pi^C,\sigma_{I^C}\right)\right)}\\&\times\left[\frac{\left[t^C\right]^{\frac{\zeta\left(C,\bar{T},R,\pi^C,\sigma_{I^C}\right)d^C}{\bar{T}-d^C}-1}\left[\bar{T}-t^C\right]^{\zeta\left(C,\bar{T},R,\pi^C,\sigma_{I^C}\right)-1}}{\left[\bar{T}\right]^{\frac{\zeta\left(C,\bar{T},R,\pi^C,\sigma_{I^C}\right)d^C}{\bar{T}-d^C}+\zeta\left(C,\bar{T},R,\pi^C,\sigma_{I^C}\right)-1}}\right]\end{aligned}$$

where $t^C\in\left[0,\bar{T}\right]$, $B\left(\cdot,\cdot\right)$ denotes the beta function, and

$$\begin{aligned}\zeta\left(C,\bar{T},R,\pi^C,\sigma_{I^C}^2\right)=&\exp(\zeta_0MINOR+\zeta_1MAJOR+\zeta_2\sigma_{I^C}\\&+(\zeta_3\text{INVEST}+\zeta_4\text{NEG}+\zeta_5\text{CCONF})\pi^C\\&+(\zeta_6\text{INVEST}+\zeta_7\text{NEG}+\zeta_8\text{CCONF})\sigma_{I^C}\\&+(\zeta_9\text{FIXEL}+\zeta_{10}(1-\text{FIXEL})\bar{T}))\end{aligned}$$

[7] These assumptions make the parameterizations of $F_d(\cdot|\cdot)$ and $F_T(\cdot|\cdot)$ highly flexible.

So the model parameters are $(\alpha, \delta, \phi, \rho, \gamma, \zeta, \lambda)$, where $\alpha = (\alpha_0, \alpha_1, \alpha_2)$, $\gamma = (\gamma_0, \ldots, \gamma_{15})$, $\zeta = (\zeta_0, \ldots, \zeta_{10})$ and $\lambda = (\lambda_0, \lambda_1)$.

2.5 Estimation Results

Table 6 reports the maximum likelihood estimates for the parameters of the model. That is, it gives estimates of $\theta = (\alpha, \delta, \phi, \rho, \gamma, \zeta, \lambda)$ [8] . These estimates will be used for the results in Sections 2.7-3.4. Many of the estimates do not have a natural substantive interpretation. We now discuss those that do. We then turn to the 'goodness of fit' of the model in Section 2.6.

Likelihood of Being the Formateur Refer to Equation (1.1). Note that α_0 draws a relationship between size and the probability of being formateur; α_1 draws a relationship between incumbency and the probability of being formateur. The relationship between size (respectively, incumbency) and the probability of being formateur is nonlinear. This implies that the effect of size (respectively, incumbency) on the probability of being formateur will depend on both the estimates of α_0 and α_1.

The relationship between size and the selection of formateur is addressed by calculating the elasticity of the probability that party i is the formateur with respect to party i's size: $\partial \ln p_i / \partial \ln \pi_i = \alpha_0 \pi_i (1 - p_i)$, where p_i depends on both α_0 and α_1. For each party in the sample, we can compute the average elasticity across all observations. We then use this to compute the average elasticity across all parties. The estimate of this elasticity is 1.079, with an associated standard error of 0.09. This means that when the party's size increases by 1%, the probability of being formateur

[8] The standard errors are estimated by a bootstrap approach. This paper simulates 100 bootstrap samples. In each boot strap sample, it draws 200 government observations from the original sample (with replacement) and estimates the coefficients in likelihood function using these bootstrap samples. All stand errors in this paper are based on this same bootstrap approach

Variable	*Estimates*	*Standard Error*	*Variable*	*Estimates*	*Standard Error*
α_1	8.678	0.97	δ	0.807	0.01
α_2	1.683	0.22	γ_0	-1.468	0.05
α_3	1.947	0.22	γ_1	11.474	0.27
ζ_0	0.238	0.07	γ_2	-9.758	0.44
ζ_1	0.082	0.09	γ_3	8.667	0.23
ζ_2	-1.187	0.11	γ_4	-12.222	0.53
ζ_3	-0.845	0.08	γ_5	3.634	0.26
ζ_4	-5.855	0.19	γ_6	-0.243	0.11
ζ_5	-2.439	0.15	γ_7	-0.393	0.05
ζ_6	1.304	0.11	γ_8	-2.093	0.12
ζ_7	1.486	0.12	γ_9	4.080	0.32
ζ_8	1.864	0.23	γ_{10}	-1.603	0.15
ζ_9	1.882	0.09	γ_{11}	0.830	0.04
ζ_{10}	0.151	0.08	γ_{12}	-2.773	0.10
λ_0	1.479	0.02	γ_{13}	2.860	0.08
λ_1	-1.152	0.03	γ_{14}	-3.939	0.10
ρ	1681.336	399.90	γ_{15}	-2.013	0.09
ϕ	20.870	0.01	Log Likelihood	-2084.234	

Table 2.6 – Maximum Likelihood Estimates (200 Observations)

increases by approximately 1%. As a consequence, if a party splits or merges, it will not affect the party's likelihood of being formateur.

The relationship between incumbency and the selection of formateur is addressed by calculating the incumbency premium. This is the additional likelihood of party i being the formateur when party i is the incumbent vs. when party i is not the incumbent. We can use two different measures of the incumbency premium. The first measure calculates the premium for each party i that is the incumbent, and then computes the average across those parties; the second measure calculates the premium for each party i that is not the incumbent, and then computes the average across those parties.

For the first measure, consider a party i that contains the former prime minister. Let p_i be the likelihood that party i is the formateur. Holding all else equal, let $\bar{p}_i^j$ be the likelihood that party i is the formateur when party $j \neq i$ is the incumbent. Write $\bar{p}_i = \frac{\sum \bar{p}_i^j}{N-1}$. This is the average likelihood that party i is the formateur when its incumbency advantage is removed. The first measure calculates party i's incumbency premium as $p_i - \bar{p}_i$, and then computes the average across all parties that contain the former prime minister. The average estimate for this measure is 0.289, with an associated standard error of 0.06. This means that, controlling for size, on average an incumbent party is 28.9% more likely to be selected as formateur than it would be if it were not the incumbent.

For the second measure, consider a party i that does not contain the former prime minister. Let $\bar{p}_i'$ be the average likelihood that party i is the formateur when party i is not the incumbent. Holding all else equal, let p_i' be the likelihood that party i is the formateur when party i is the incumbent. The second measure calculates party i's incumbency premium as $p_i' - \bar{p}_i'$, and then computes the average across all parties that do not contain the former prime minister. The average estimate of this measure is

0.167, with an associated standard error of 0.05. This means that, controlling for size, on average, a non-incumbent party is 16.7% less likely to be selected as formateur than it would be if it were the incumbent.

Preference for Policy vs. Office Perks The premise of this dissertation is that legislators are motivated by both ideology and office benefits. Each of these incentives has been discussed in the theoretical literature. (See Hotelling (1929), Wittman (1983), Calvert (1985), Callander (2008).) The estimated model allows us to partially address the extent to which legislators are, in practice, motivated by ideology over office benefits. Specifically, it allows us to address the extent to which *all* parties within a given (perhaps unobserved) coalition are motivated by ideology over office benefits, relative to what equilibrium in the bargaining game would be.

This is addressed by making use of the estimates for both ϕ and $(b_i : i \in C)$ for all proto-coalitions $C \subseteq N$. Specifically, for each (possibly unobserved) proto-coalition C, compute C's equilibrium payoff from policy relative to office benefits

$$\frac{\sum_{i \in C} b_i \exp[-(I_i - I^C)^2]}{\phi}. \tag{2.7}$$

Notice that, $b_i \exp[-(I_i - I^C)^2]$ is party i's ideological preference, which is the estimated preference weight b_i times a metric of party i's ideological distance to government policy. So a coalition's ideological preference is the sum over ideological preferences of all parties in that coalition, i.e., the numerator of Equation (2.7). The denominator of Equation (2.7) is the total benefits for a coalition, which is the estimate ϕ. So a coalition's preference weight of ideology over office benefits is the coalition's ideological preference divided by the total office benefits for that coalition.

The average of this measure across all proto-coalitions C is about 9.45%. The maximum of this measure (across all proto-coalitions C) is about 32.27%. The average of this measure across all realized governments in data is about 4.40%. The maximum

of this measure (across all realized governments) is about 11.99%. This indicates that, in equilibrium, coalitions care more about office benefits than policy.

Distaste for Bargaining The estimate of the distaste for bargaining is 0.807 with a standard error of 0.095. This implies a moderate distaste for bargaining on the part of political parties.

2.6 Goodness of Fit

This section addresses the fit of the model. In particular, it focuses on five observed variables and compares the density functions predicted by the model to the density functions in the data. These five variables are the formateur's seat share, the number of attempts to form a government, government duration, the size of the government, and the ideological diversity of the government.

Refer to Tables 2.7-2.11. These tables put the $q = 200$ observations of each variable into one of $1, \ldots, H$ bins. Within each bin, it computes the empirical density function of the variable from the data, $g(\cdot)$, and the predicted density function from the model $\hat{g}(\cdot)$. It evaluates how well the model fits the data by Pearson's χ^2 test. In particular, it assumes that

$$q \sum_{j=1,\ldots,H} \frac{[g(j) - \hat{g}(j)]}{\hat{g}(j)},$$

follows a χ^2 distribution with $H - 1$ degrees of freedom. The last row of each table shows that the χ^2 goodness of fit test does not reject the model at conventional significance levels.

Interval	Data	Model
0%-10%	0.025	0.044
10%-20%	0.085	0.058
20%-30%	0.135	0.128
30%-40%	0.215	0.228
40%-50%	0.445	0.451
50%+	0.095	0.092
χ^2 test	4.359	
$Pr(\chi^2(5) \geq 4.359)$	0.499	

Table 2.7 – Density Functions of Formateur Size and Goodness-of-Fit

Interval	Data	Model
1	0.610	0.606
2	0.205	0.189
3	0.085	0.087
4	0.065	0.046
5	0.020	0.026
6	0.005	0.015
7	0.010	0.010
8+	0.000	0.021
χ^2 test	7.858	
$Pr()\chi 2(7) \geq 7.858)$	0.345	

Table 2.8 – Density Function of Attempts and Goodness-of-Fit

Interval	Data	Model
0-1 yr	0.360	0.352
1 yr - 2 yr	0.315	0.224
2 yr - 3 yr	0.165	0.219
3 yr - 4 yr	0.140	0.196
4 yr - 5 yr	0.020	0.018
χ^2 test	13.274	
$Pr(\chi^2(4) \geq 13.274)$	0.151	

Table 2.9 – Density Functions of Government Duration and Goodness-of-Fit

Interval	Data	Model
0%-10%	0.000	0.001
10%-20%	0.010	0.013
20%-30%	0.010	0.034
30%-40%	0.095	0.100
40%-50%	0.330	0.300
50%-60%	0.350	0.327
60%-70%	0.130	0.130
70%-80%	0.045	0.049
80%-90%	0.025	0.035
90%-100%	0.005	0.011
χ^2 test		6.036
$Pr(\chi^2(9) \geq 6.036)$		0.812

Table 2.10 – Density Functions of Government Size and Goodness-of-Fit

Interval	Data	Model
0-0.1	0.400	0.339
0.1-0.35	0.115	0.113
0.35-0.48	0.085	0.076
0.48-0.75	0.115	0.155
>0.75	0.285	0.318
χ^2 test	5.178	
$Pr(\chi^2(4) \geq 5.178)$	0.270	

Table 2.11 – Density Functions of Ideological Diversity and Goodness-of-Fit

2.7 Equilibrium Analysis

How does size affect expected government duration? How does ideological diversity affect expected government duration? This section studies the effect of size (respectively, ideological diversity) on duration, holding fixed ideological diversity (respectively, size).

In answering these questions, the term expected government duration can take on two meanings. The first is unconditional expected duration (i.e., expected duration before a government is formed). This is measured by $\hat{E}[d^C|\bar{T} = 1000, \pi^C, \sigma_{I^C}, R_i]$. The second is conditional expected duration (i.e., expected duration conditional upon forming the government). This is measured by $\hat{E}[d^C|d^C > y^C(\bar{T} = 1000, \pi^C, \sigma_{I^C}, R_i)]$.

To compute the effect of size (respectively, ideological diversity) on expected duration, this paper focuses on the quantiles of size and ideological diversity within which most of the observations lie. Figures 2.7-2.22 report these effects. The upper left graphs show the (partial equilibrium) effects of size on duration, at low, medium and high levels of ideological diversity. The upper right graphs show the effects of ideological diversity on duration, at low, medium and high levels of size. Figures 2.7 through 2.22 differ in their institutional environments.

The effect of size on duration is non-decreasing for minority governments and non-increasing for majority governments *under all institutional environments*. Moreover, changing any one institutional rule—holding all other institutional rules in the environment constant—does not have a large effect on the rate at which size increases duration.

The effect of ideological diversity on duration *varies across institutional environments*. In particular, for some institutional environments increasing ideological diversity increases duration, while for other institutional environments it decreases

duration. Adding the investiture vote or adding a constructive vote of no confidence to the institutional environment appears to add a positive trend to the effect of ideological diversity on duration. Adding a negative parliamentarism to the institutional environment appears to add a negative trend to the effect of ideological diversity on duration. Adding a fixed interelection period appears to have no effect on the relationship between ideological diversity and duration.

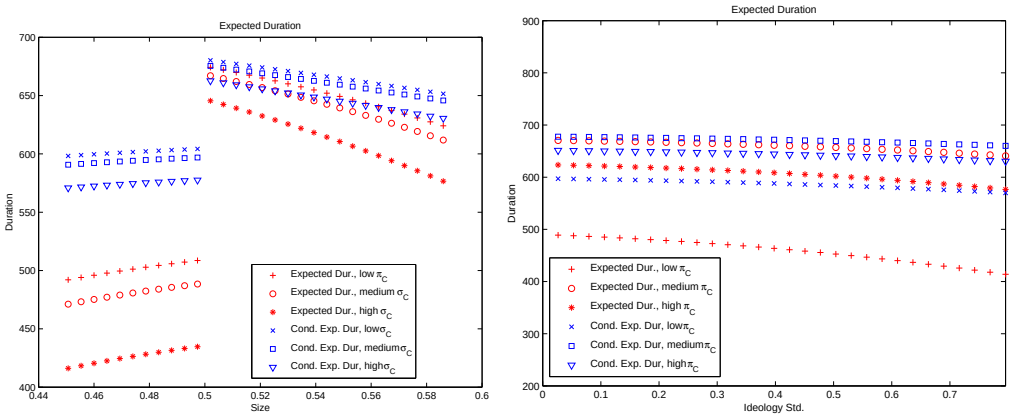

Figure 2.7 – Plots For INVEST=N,PARL=+,CVOTE=N,FIX=N

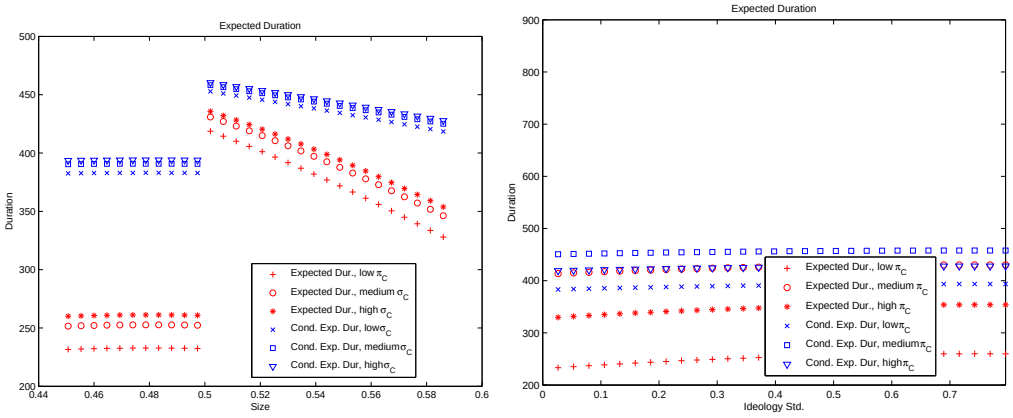

Figure 2.8 – Plots For INVEST=Y,PARL=+,CVOTE=N,FIX=N

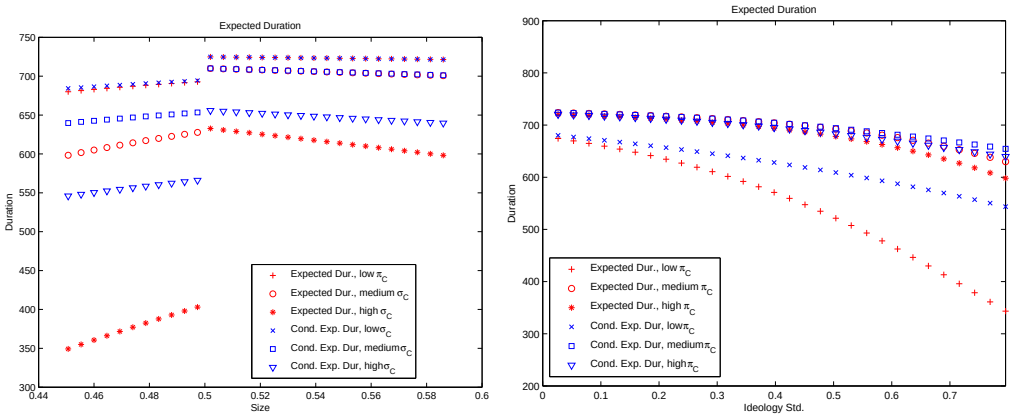

Figure 2.9 – Plots For INVEST=N,PARL=-,CVOTE=N,FIX=N

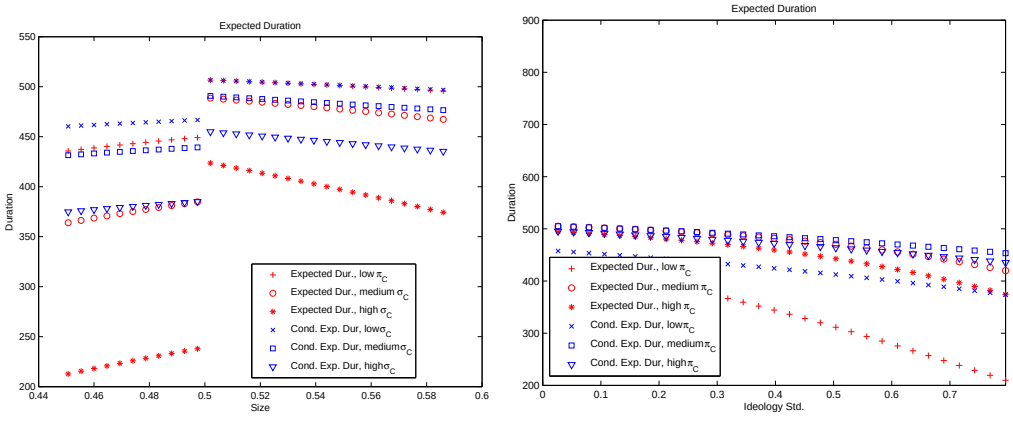

Figure 2.10 – Plots For INVEST=Y,PARL=-,CVOTE=N,FIX=N

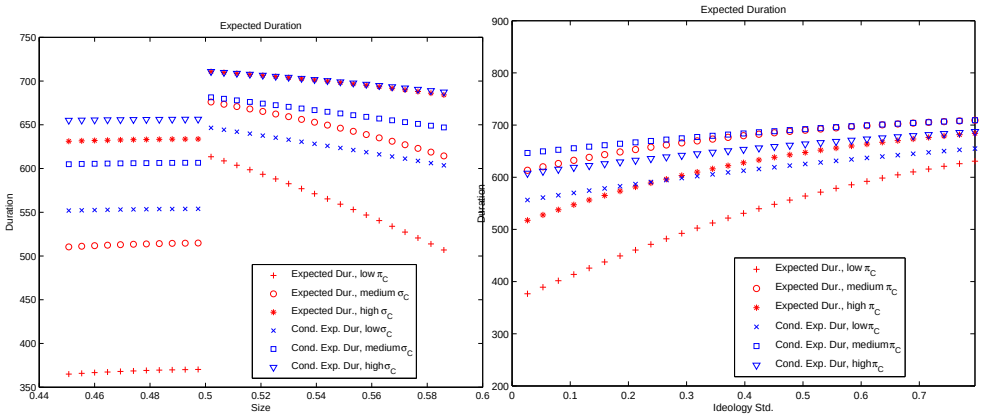

Figure 2.11 – Plots For INVEST=N,PARL=+,CVOTE=Y,FIX=N

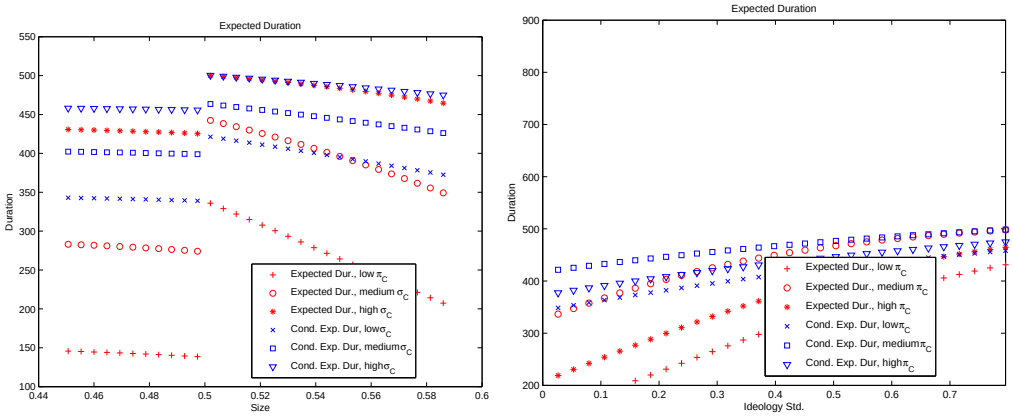

Figure 2.12 – Plots For INVEST=Y,PARL=+,CVOTE=Y,FIX=N

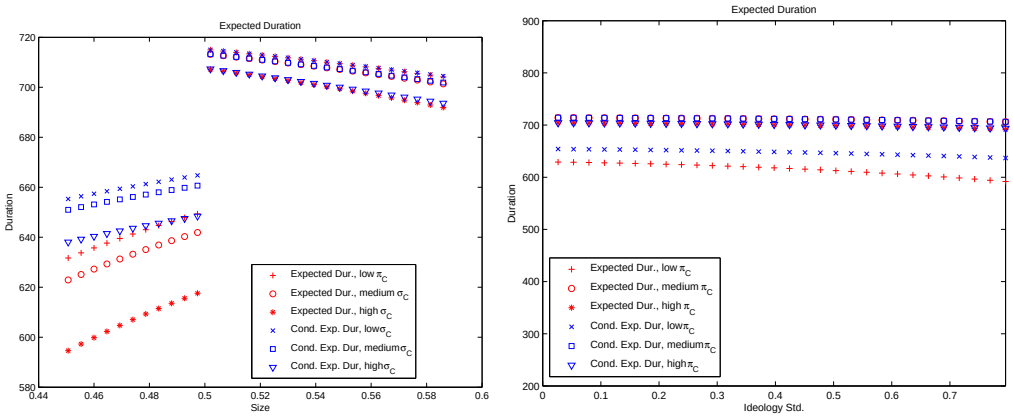

Figure 2.13 – Plots For INVEST=N,PARL=-,CVOTE=Y,FIX=N

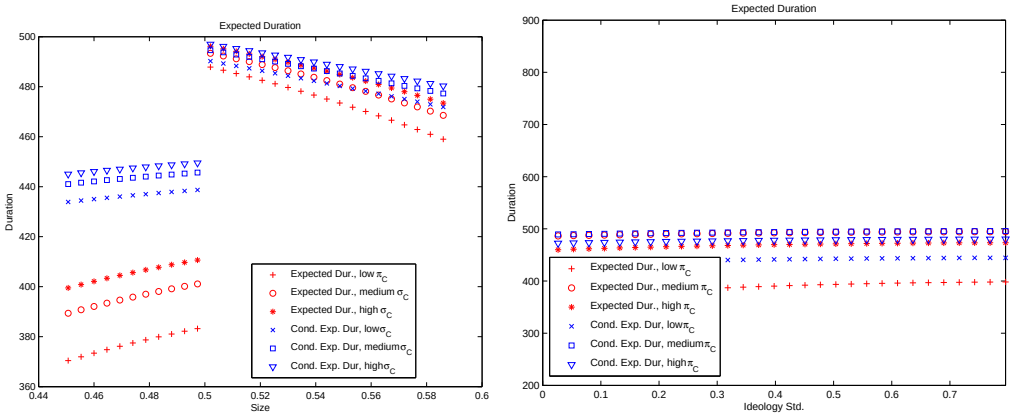

Figure 2.14 – Plots For INVEST=Y,PARL=-,CVOTE=Y,FIX=N

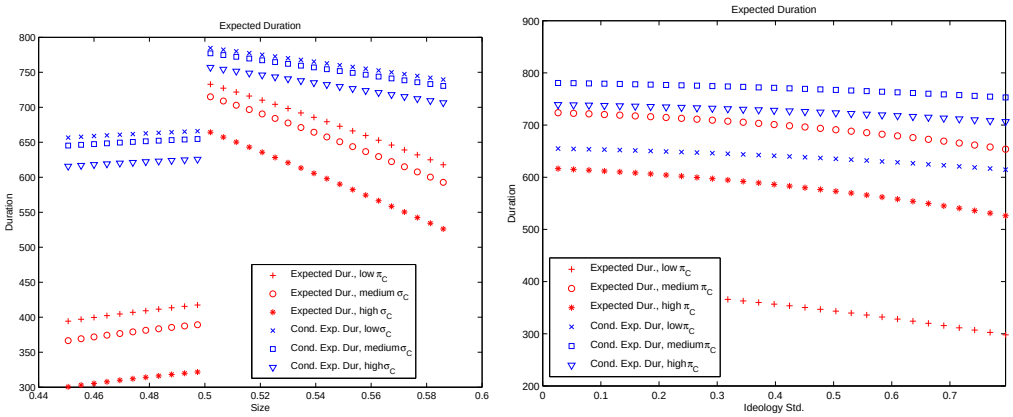

Figure 2.15 – Plots For INVEST=N,PARL=+,CVOTE=N,FIX=Y

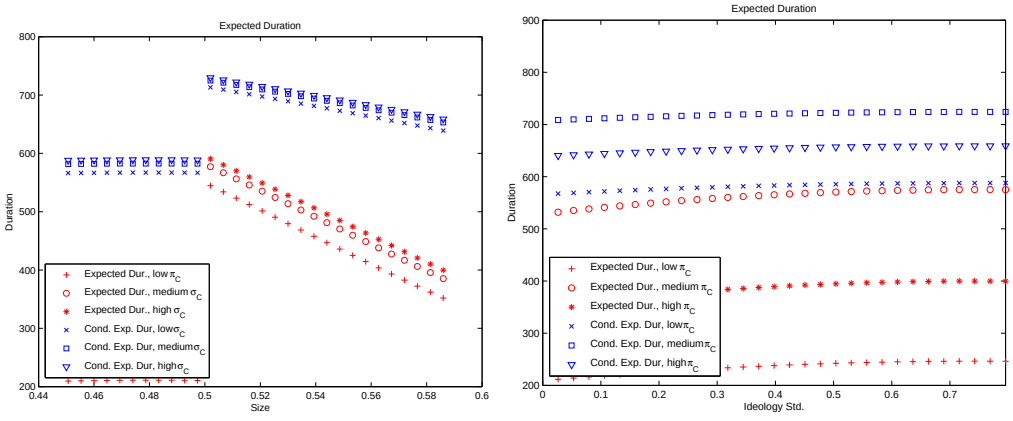

Figure 2.16 – Plots For INVEST=Y,PARL=+,CVOTE=N,FIX=Y

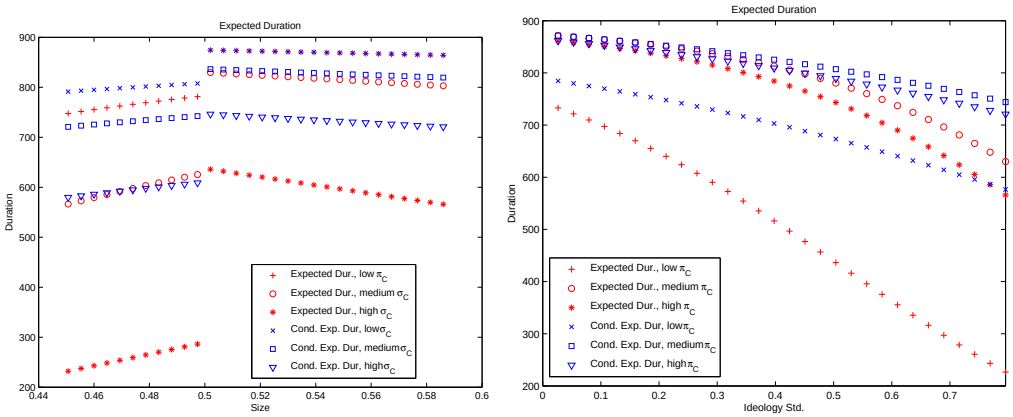

Figure 2.17 – Plots For INVEST=N,PARL=-,CVOTE=N,FIX=Y

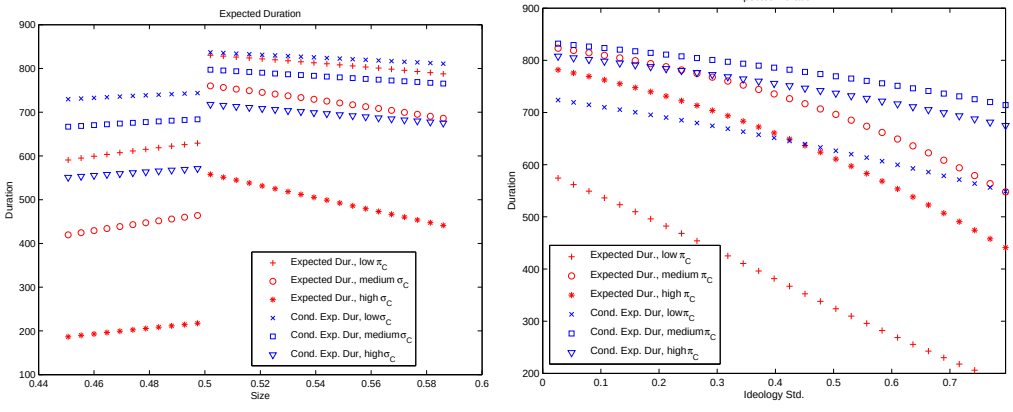

Figure 2.18 – Plots For INVEST=Y,PARL=-,CVOTE=N,FIX=Y

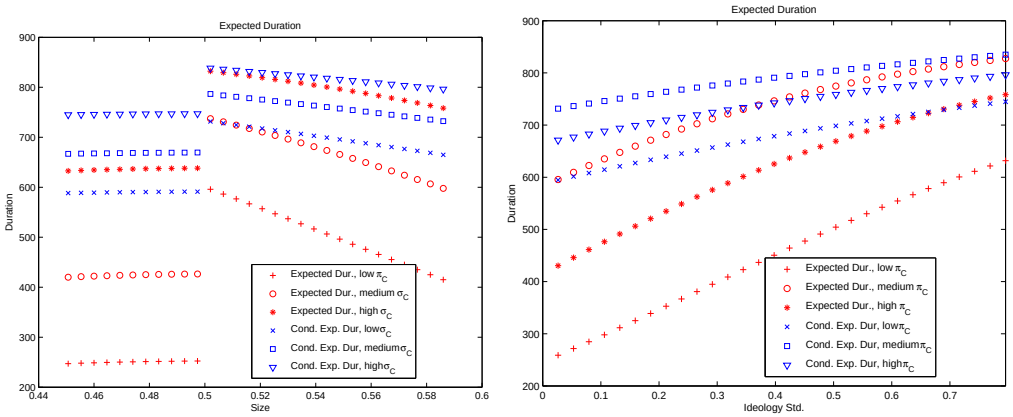

Figure 2.19 – Plots For INVEST=N,PARL=+,CVOTE=Y,FIX=Y

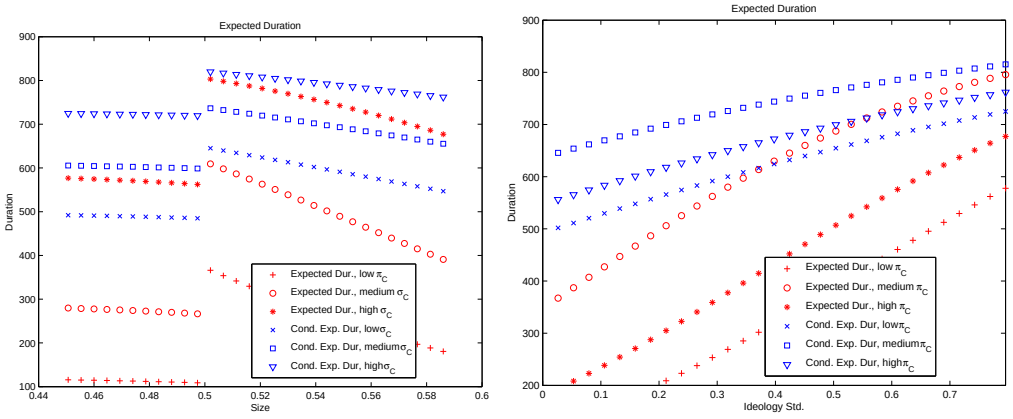

Figure 2.20 – Plots For INVEST=Y,PARL=+,CVOTE=Y,FIX=Y

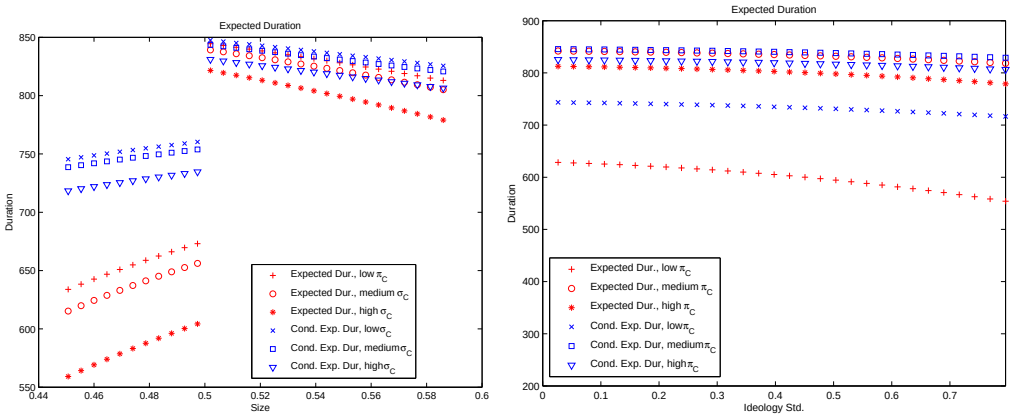

Figure 2.21 – Plots For INVEST=N,PARL=-,CVOTE=Y,FIX=Y

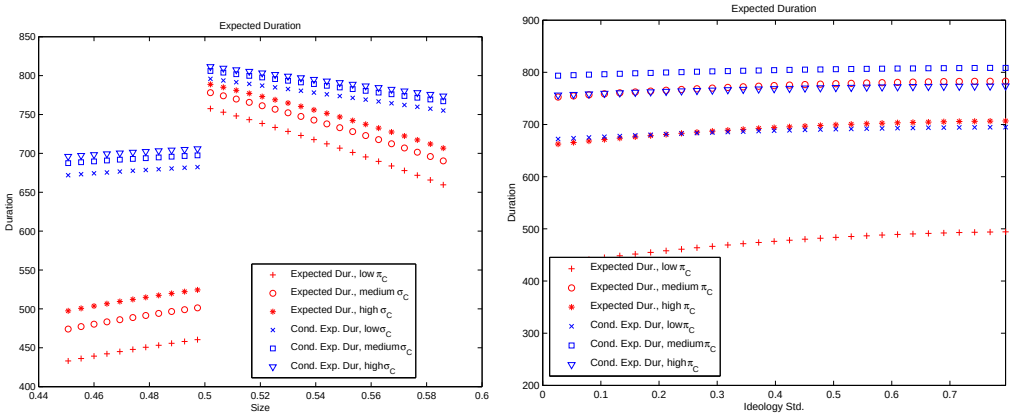

Figure 2.22 – Plots For INVEST=Y,PARL=-,CVOTE=Y,FIX=Y

Chapter 3

INSTITUTIONAL REFORM AND GOVERNMENT FORMATION IN PARLIAMENTARY DEMOCRACIES

3.1 Introduction

How do institutions influence government outcomes? Chapter 2 studied the effect of changing an institution on the specific outcome of duration, holding fixed the composition of the government, i.e., ideological diversity and size. For instance, adding the investiture vote to the institutional environment serves to decrease duration for any given level of ideological diversity and size. This is the direct effect on duration.

The analysis in Chapter 2 was incomplete for two reasons. First, the direct effect of changing institutions on duration may lead the formateur to make a different choice of coalition. This may, in turn, have indirect effects on both policy and government duration. Second, the analysis was silent about policy implications. However, understanding the effects on policy requires understanding how parliamentary characteristics and institutions change the *actual* choice of coalition.

This chapter turns to the question of how parliamentary characteristics and institutions affect the choice of coalition and coalitional outcomes, by pinning down the actual choice of coalition. In particular, this chapter uses the estimated model in Chapter 2 to predict the composition of the government and government outcomes associated with different institutional environment, i.e. it conducts the counterfactual experiments by varying institutions. In so doing, we can address (a) which institutions leads to 'good' government outcomes; and (b) how should we reform current institutions.

The results of counterfactual experiments have important implications both for the composition of the Government and for institutional reform. Begin with the composition of the Government. The counterfactual experiments show that both the ideological diversity and size of the Government vary across institutions. For instance, adding an investiture vote increases the ideological diversity of the Government and typically also increases the size of the Government. See Section 3.4. The predictions match the data feature that we described in Section 1.4 of Chapter 1.

Now turn to the question of institutional reform. Within parliamentary democracies, institutions are typically evaluated by the length of government duration. (See e.g. Taylor and Herman (1971), Dodd (1976), Sanders and Herman (1971), Warwick (1979), Lijphart (1984), Strøm (1985), Warwick (1994), Diermeier *et al.* (2003), etc.) The implicit assumption is that Governments with longer duration are better—in parliamentary democracies, longer duration should be associated with stability and, so, better policies. However, the counterfactual experiments show that the implicit assumption may fail: Governments with longer duration may also come with larger ideological losses for voters. In particular, the set of institutions associated with the largest length of government duration also comes with significant ideological losses for voters. Thus, a given institutional reform should be evaluated relative to a benchmark based on both duration and policy. Interestingly, the counterfactual experiments show that the set of institutions that minimize ideological losses for voters is also associated with a long length of government duration. (It differs from the maximum length of government duration by only six days.) See Section 3.4.

The counterfactual experiments also highlight the fact that an institutional change must be evaluated relative to other rules in the environment. The typical exercise is to evaluate a given institutional reform, holding all other features of the environment constant. The implicit assumption is that there are no synergies between institu-

tions. But the counterfactual experiments show that there are important synergies. For instance, positive parliamentarism decreases voters' ideological losses only in the presence of either a constructive vote of no confidence or a fixed interelection period. Likewise, a constructive vote of no confidence increases duration if and only if positive parliamentarism is required by the institutional environment. (Section 3.4 discusses additional synergies.) Thus, synergies between institutions have important implications for normative political economy.

3.2 Voters' Ideological Losses

To compute voters' ideological losses, we assume that the electoral outcome reflects voters' ideological positions. More specifically, we assume, that prior to the game, there is an electoral stage. In the electoral stage, there is a unit mass of voters, who each vote sincerely. These votes are exogenous to the coalition formation process. Thus, using the seat distribution and ideological positions of the elected parties, we can back out the ideological composition of voters. We can then compute voters' ideological losses by integrating the squared distance between voter ideology and the government policy [1] .

Notice, because voters elect the parliament, it is assumed that the election outcomes represent the voters' preferences. But these preferences need not be reflected by the government outcomes. (The government is *not* elected directly by voters.) There may be a gap between the voter preferences and government outcomes. This gap may differ according to different institutions. Sections 3.3 and 3.4 will point to how different institutional environments influence this gap.

[1] The ideological loss of a government formed by coalition C is $\sum_{i \in C} \pi_i (I_i - I^C)^2$.

3.3 An Example

We now use an example to illustrate how parliamentary characteristics and institutions affect the choice of coalition and government outcomes. Assume there are three parties in the parliament, $1, 2, 3$. Let party 1 be the formateur. So the set of possible proto-coalitions is

$$\Delta = \{\{1\}, \{1,2\}, \{1,3\}, \{1,2,3\}\}.$$

The seat share distribution is $\pi = (0.407, 0.477, 0.116)$. Parties' ideological positions are $I = (0.4, 0.3, -0.4)$ and parties do not differ in their preference weights. Take the time to next election to be $\bar{T} = 1000$. The institutional environment is (INVEST $= Y$, PARL $= +$, CVOTE $= N$, FIX $= N$). We use the estimated model to compute the associated outcomes of the game, for each possible coalition. We then pin down the formateur's choice of the coalition, i.e., compute the likelihood that any given coalition is chosen as the proto-coalition.

Coalition	Likelihood	Size	Dissimilarity	Duration	Ideological Loss
{1}	0.459	0.407	0.000	380	0.079
{1,2}	0.027	0.884	0.071	269	0.067
{1,3}	0.497	0.523	0.566	451	0.127
{1,2,3}	0.017	1.000	0.436	227	0.074
Expected		0.49	0.29	409	0.10

Table 3.1 – Benchmark Case

Table 3.1 reports the likelihood of each possible coalition being the proto-coalition and the associated size, ideological diversity, government duration and ideological losses for voters. Under this environment, $C = \{1, 3\}$ is the coalition that is most

likely to be formed. This is an ideologically disconnected coalition. It can be shown that the associated government policy for this coalition is $I^C = 0$. This results in the largest voter ideological losses, since it is assumed that the election outcome represent the voters' preferences.

We next change parliamentary characteristics and institutions. This will influence the formateur's choice of the coalition and the associated government outcomes.

Changing Parliamentary Characteristics In the benchmark case, each party in the parliament had a minority seat share. We now change the parliamentary characteristics by increasing the seat share of party 1 to a majority. (This changes the ideological composition of the parliament.) The seat share distribution is now $\pi' = (0.507, 0.377, 0.116)$. For this new parliament, Table 3.2 reports the likelihood of each possible coalition being the proto-coalition and the associated size, ideological diversity, government duration and ideological losses for voters. In this parliament, $C' = \{1\}$ is the coalition that is most likely to be formed. Now, the formateur excludes the ideologically extreme party 3. This results in shorter duration and smaller ideological losses for voters.

Coalition	Likelihood	Size	Dissimilarity	Duration	Ideological Loss
{1}	0.673	0.507	0.000	449	0.078
{1,2}	0.018	0.884	0.071	269	0.067
{1,3}	0.300	0.623	0.566	409	0.134
{1,2,3}	0.009	1.000	0.436	227	0.078
Expected		0.55	0.17	432	0.09

Table 3.2 – Changing Parliament

This change in parliamentary characteristics changes the formateur's choice of coalition. One reason the formateur may make this change is because the institutional environment contains an investiture vote. Recall, if the environment contains an investiture vote, the government needs a vote by parliament to legally assume office. In the benchmark case, the formateur is a minority party; with an investiture vote in place, the formateur has an incentive to include an additional party to achieve a majority. When we change formateur's seat share to a majority, the formateur looses this incentive to include another party and so forms a coalition by itself.

Changing Institution Return to the benchmark example. Now, instead, remove the investiture vote from the institutional environment. Table 3.3 reports the formateur's choice of coalition and the associated government outcomes. When the investiture vote is removed, the formateur loses the incentive to form a majority coalition. Now, $C' = \{1\}$ is again the coalition that is most likely to be formed. The formateur again excludes the ideologically extreme party 3. This now results in a longer duration and smaller ideological losses for voters.

Coalition	Likelihood	Size	Dissimilarity	Duration	Ideological Loss
{1}	0.662	0.407	0.000	590	0.079
{1,2}	0.018	0.884	0.071	529	0.067
{1,3}	0.313	0.523	0.566	650	0.127
{1,2,3}	0.006	1.000	0.436	464	0.074
Expected		0.46	0.18	607	0.09

Table 3.3 – Changing Institution

3.4 Simulation

This section builds on the example to conduct counterfactual institutional experiments. In particular, it considers an artificial political system with five parties $N = \{1, \ldots, 5\}$ and $\bar{T} = 1000$. It simulates the outcomes of 100 elections by randomly drawing (a) vectors of the parties' seat shares in parliament from a uniform distribution on $\Pi = (\pi_1, \ldots, \pi_5 : \pi_i \in (0, 0.5), \sum_{i \in N} \pi_i = 1)$, (b) vectors of ideological positions from a uniform distribution on $[-2, 2]$, (c) the identity of the party that contains the former prime minister, and (d) vectors of raw preference weights from a uniform distribution on $[0, 20]$ [2] . For each draw of parliamentary characteristics and each possible coalition configuration thereof, it uses the estimated model to compute the predicted distribution of negotiation rounds, government duration, and government policy. It then averages across all draws of parliamentary characteristics and coalitional configurations.

This simulation is repeated under 16 different institutional environments. These correspond to whether the environment has an investiture vote (INVEST=Y), negative parliamentarism (PARL=-), a constructive vote of no confidence (CVOTE=Y), and a fixed interelection period (FIX=1). Table 3.4 gives notation for the combination of institutional rules.

Table 3.5 provides the simulation results. Notice, government size differs across institutional environments. It ranges from 45% to 55%, encompassing both minority and majority governments. Government duration also differs across institutional environments, ranging from 172.21 to 749.44 days. A longer government duration can be associated with both better and worse policies from the perspective of voter welfare. The set of institutional rules with the longest government duration involves

[2]The range of the draws is the same as the raw data of preference weights.

Notation	INVEST	PARL	CVOTE	FIX	Notation	INVEST	PARL	CVOTE	FIX
R_1	N	+	N	N	R_9	N	+	N	Y
R_2	Y	+	N	N	R_{10}	Y	+	N	Y
R_3	N	-	N	N	R_{11}	N	-	N	Y
R_4	Y	-	N	N	R_{12}	Y	-	N	Y
R_5	N	+	Y	N	R_{13}	N	+	Y	Y
R_6	Y	+	Y	N	R_{14}	Y	+	Y	Y
R_7	N	-	Y	N	R_{15}	N	-	Y	Y
R_8	Y	-	Y	N	R_{16}	Y	-	Y	Y

Table 3.4 – Institutional Environments

no investiture vote, positive parliamentarism, a constructive vote of no confidence, and a fixed interelection period (R_{13}). However, this set of institutions has significant ideological losses for voters. Now, add an investiture vote to this environment, i.e., go to R_{14}. This new institutional environment minimizes the voters' ideological losses and results in decreasing government duration by only 6 days. Interestingly, the institutional environment that has the shortest duration (R_8) has large ideological losses for voters and the institutional environment with the largest ideological losses for voters (R_2) has a relatively short duration.

We now highlight how changing various institutions effects both the composition of the government and government outcomes.

Investiture Vote Adding an investiture vote to the institutional environment increases the ideological diversity of governments. It typically also increases the size of governments. (The exception is when an investiture vote is added to the environment that has a positive parliamentarism, a constructive vote of no confidence, and a fixed interelection period.) It typically decreases government duration. (The exception is when an investiture vote is added to the environment that has a negative parlia-

Institution	Duration	Attempts	Size	Ideology Std	Gov Policy	Ideological Loss
R1	583.37	1.64	0.49	0.35	-0.01	11.20
	(19.56)	(0.14)	(0.05)	(0.1)	(1.39)	(10.54)
R2	391.37	2.24	0.53	0.50	-0.24	12.71
	(7.93)	(0.13)	(0.03)	(0.16)	(1.27)	(9.29)
R3	352.18	1.22	0.45	0.18	-0.04	10.39
	(72.76)	(0.11)	(0.08)	(0.06)	(1.69)	(8.65)
R4	192.35	1.52	0.52	0.31	0.19	10.86
	(35.6)	(0.17)	(0.05)	(0.07)	(1.2)	(8.11)
R5	607.13	1.39	0.51	0.62	0.33	10.17
	(29.19)	(0.14)	(0.03)	(0.24)	(1.08)	(9.26)
R6	419.47	1.76	0.55	0.70	-0.05	8.34
	(34.04)	(0.37)	(0.05)	(0.23)	(0.96)	(7)
R7	233.97	1.24	0.49	0.32	0.10	10.41
	(58.38)	(0.08)	(0.05)	(0.11)	(1.24)	(6.82)
R8	172.21	1.39	0.54	0.48	0.00	10.23
	(58.76)	(0.05)	(0.04)	(0.17)	(1.1)	(7.48)
R9	670.53	2.24	0.51	0.40	0.23	9.41
	(22.57)	(0.22)	(0.02)	(0.12)	(1.17)	(6.53)
R10	625.96	2.92	0.52	0.55	-0.14	9.46
	(26.11)	(0.35)	(0.02)	(0.16)	(1.12)	(7.18)
R11	543.33	1.56	0.46	0.17	-0.04	9.96
	(78.69)	(0.24)	(0.07)	(0.07)	(1.49)	(5.57)
R12	479.80	1.97	0.47	0.20	0.04	10.88
	(61.15)	(0.3)	(0.05)	(0.06)	(1.65)	(8)
R13	749.44	1.60	0.52	0.76	0.01	9.45
	(41.91)	(0.31)	(0.04)	(0.3)	(1.16)	(8.73)
R14	743.48	1.75	0.51	0.88	-0.06	7.42
	(54.52)	(0.49)	(0.04)	(0.3)	(1.09)	(7.08)
R15	392.76	1.49	0.52	0.40	-0.10	10.76
	(72.13)	(0.11)	(0.04)	(0.13)	(1.29)	(9.54)
R16	430.04	1.75	0.53	0.53	-0.08	9.50
	(89.53)	(0.12)	(0.03)	(0.16)	(1.02)	(6.82)

Table 3.5 – Simulation Result

mentarism, a constructive vote of no confidence, and a fixed interelection period.) It decreases voters' ideological losses if and only if there is a constructive vote of no confidence.

Positive versus Negative Parliamentarism Positive parliamentarism increases the ideological diversity of governments. It typically also increases the size of governments. (The exception is when positive parliamentarism is required in the presence of an investiture vote, a constructive vote of no confidence, and a fixed interelection period.) It increases government duration. It decreases voters' ideological losses in the presence of either a constructive vote of no confidence or a fixed interelection period. Otherwise, it increases voters' ideological losses.

Constructive Vote of No Confidence Adding a constructive vote of no confidence increases the ideological diversity of governments. It typically also increases the size of governments. (The exception is when a constructive vote of no confidence is added to the environment that has an investiture vote, positive parliamentarism, and a fixed interelection period.) It increases duration under positive parliamentarism but decreases it under negative parliamentarism. It has mixed effects on voters' ideological losses. In the presence of an investiture vote it decreases voters' ideological losses.

Fixed Interelection Period Adding a fixed interelection period typically increases ideological diversity. (The exception comes when there is neither positive parliamentarism nor a constructive vote of no confidence.) It increases size if and only there is no investiture vote. A fixed interelection period increases government duration. It typically decreases voters' ideological losses. (There are two exceptions.)

Notice that the effect of adding any one institution to the environment has different effects on government outcomes, depending on the other institutional rules already in place. These effects can be different from the direct effects we studied in Section 2.7. For instance, consider adding a constructive vote of no confidence to an institutional environment. Section 2.7 shows that this has a direct effect of increasing government duration. Here we see that it can increase or decrease government duration, depending on whether there is positive or negative parliamentarism in the environment. Apparently, adding a constructive vote of no confidence has an indirect effect: It may cause the formateur to change its choice of coalition and, in turn, change the associated government outcomes. The formateur's incentive to change its coalitional choice appears to depend on whether the environment requires positive parliamentarism.

This last fact has important implications for normative political economy. Typically, institutional changes are evaluated by studying the effect of adding a given institution to an institution-free environment. We now see that, in practice, there may be synergies between institutional rules. As a consequence, it is necessary to evaluate the effect of adding a given institution to 'rich' institutional environments.

3.5 Discussion: Synergies Between Institutions

The counterfactual experiments suggest there are important synergies between institutions. We now use an example to illustrate why these synergies arise.

Example: Italy vs. Denmark Notice that the current institutional environments of Italy and Denmark are R_2 and R_3 respectively. In particular, as mentioned in Section 3.4, the current set of institutions in Italy R_2 leads to the largest ideological losses for voters. It also leads to relatively short duration. We now think about a particular institutional reform—adding a constructive vote of no confidence to the current insti-

tutional environment of Italy (i.e. moving from R_2 to R_6). (i.e. moving from R_2 to R_6) The institution—constructive vote of no confidence—was first introduced by West Germany to increase stability. In fact, it does improve stability for the institutional environment of Italy. Moreover, it also decrease votes' ideological losses. By contrast, we now consider implementing the same institutional reform in Denmark (i.e. moving from R_3 to R_7). This would have negative consequences. This institutional reform would decrease duration and increase voters' ideological losses. These differences in the effects of a same institutional reform on government outcomes are caused by the synergies between institutions. Notice that, the current institutional environments of these two countries differ. In Italy, the institutional environment has an investiture vote, positive parliamentarism; while in Denmark, the institutional environment does not have an investiture vote and only requires negative parliamentarism. Thus, whether adding a constructive vote of no confidence is beneficial depends on whether there are investiture vote and positive/negative parliamentarism. That means, there are synergies between investiture vote, positive/negative parliamentarism and constructive vote of no confidence.

Why is it that—when we add a constructive vote of no confidence to one environment is beneficial—but to the other environment, it is detrimental? Start by thinking about the environments in Italy and Denmark. In Italy there is an investiture vote and positive Parliamentarism; so, the government needs a majority support of Parliament to both assume office and remain in office. In this institutional environment, the government is highly accountable to Parliament. By contrast, In Denmark the environment does not have an investiture vote and only requires negative parliamentarism. So in the institutional environment of Denmark, the government is less accountable to Parliament.

Recall, a constructive vote of no confidence requires Parliament to find an alternate government, before it replaces the current government. So, when there is a constructive vote of no confidence, the Formateur has an incentive to create coalitions that are larger and more ideologically diverse—to make it more difficult for Parliament to find a replacement. In fact, these incentives bear out in the simulations: adding a constructive vote typically increases both ideological diversity and size. (See Section 3.4.) But, there may be many ways to increase ideological diversity and size—which parties the Formateur wants to include in its coalition depends on the other institutions in place.

Now consider adding a Constructive Vote of No Confidence in an environment of high accountability. In this case, the formateur would have an incentive to include parties that the parliament favors. We would expect to see a coalition—and so policy—that is closer to that of the parliament. Since the parliament represents voters' policy preferences, we would expect the policy that is consistent with voters' policy preferences. As a consequence, this may make it more likely for the government to survive. Instead, think about adding a Constructive Vote of No Confidence in an environment of low accountability. In this case, the formateur would have an incentive to include parties that itself favors. We would expect to see a coalition—and so policy—that is further afield from that of Parliament, and so the voters' policy preferences. As a consequence, this may make it more likely that members of Parliament attempt to overthrow to government—so we may end up with shorter duration.

The above example gives one explanation why these synergies arise: These synergies may be caused by strategic incentives amongst parties in coalition formation process. To further understand how exactly the strategic interaction cause these synergies and thus influence government outcomes requires future work.

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