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ARTICLE

Bargaining Complexity Beyond Arithmetic

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Abstract
Political scientists lack a generally accepted definition of bargaining complexity, and attempts to quantify the complexity of political negotiations as such are rare. We argue that bargaining complexity is best defined as the amount of choice facing the negotiating actors, and best operationalized as the entropy of the probability distribution across potential bargaining outcomes. We apply this general approach to 343 government formation processes in advanced democracies, predicting the selection probability of each potential government using a state-of-the-art government formation model that integrates both arithmetic factors based on the number and size of parties and interparty relations, such as ideological dispersion and pre-electoral coalitions. We then demonstrate how to use our measure to disentangle between different determinants of bargaining complexity. Lastly, we show that bargaining complexity is robustly related to how many potential governments and partners were considered but ultimately set aside during negotiations and to the resulting cabinet's durability.

Keywords: Political negotiations; Bargaining complexity; Government formation; Entropy

Introduction

Bargaining is ubiquitous in political life, in contexts ranging from government formation and other legislative decisions to international relations, intra-party candidate selection, and concertation between governments and stakeholders (for example, Laver and Schofield 1990; Lehmbruch 1977; Lijphart 2012; Sheffer et al. 2023; Zartman 1994).

Motivated not least by the increasingly fragmented party systems among advanced democratic legislatures, there has recently been a growing interest among political scientists in the implications and origins of *bargaining complexity*, in particular in the context of parliamentary parties' negotiations over government formation. However, while bargaining complexity is broadly understood as the number of viable alternatives that the negotiating actors have to consider (for example, De Winter and Dumont 2008; Laver and Schofield 1990), the concept lacks a generally accepted and clear-cut definition in legislative research (De Winter and Dumont 2008); and similar observations have been made among scholars of international relations and conflict management (Zartman 1994; Zhang et al. 2021).

What's more, rather than specifically defining and quantifying the degree of bargaining complexity *as such*, most studies on the topic have used one or more system-level characteristics that are assumed to generate bargaining complexity as approximations for the difficulties facing negotiators.

Within legislative studies, most such research has focused on the consequences of bargaining complexity for government formation outcomes.[1] Early studies in this realm approximated bargaining complexity by the number of parties in the legislature – at times operationalized as the *effective* number of parties as defined by Laakso and Taagepera (1979) – as well as their ideological dispersion (for example, Diermeier and Van Roozendaal 1998; Martin and Vanberg 2003). Later studies have considered additional proxies, including issue dimensionality of the party system, parliamentary institutions such as investiture and continuation rules, and the *a priori* familiarity of the coalition parties (see, for example, De Winter and Dumont 2008; Falcó-Gimeno and Indridason 2013; Meyer et al. 2023).

This approach has two limitations. First, the bargaining complexity is not the sole potential reason why these proxy indicators may help predict bargaining delays and other negotiation difficulties. Indeed, bargaining complexity is difficult to disentangle both conceptually and empirically from neighboring concepts, such as negotiators' uncertainty about each other's preferences and other bargaining parameters (Diermeier and Van Roozendaal 1998). Although some of the widely used proxy variables may align more closely with certain mechanisms (as discussed by Bäck et al. 2023, among others), most of them are compatible with a multitude of competing explanations for various bargaining outcomes (Martin and Vanberg 2003; Zhang et al. 2021).

The second issue lies in the weak correlation between the proxy indicators and the actual number of *viable* alternatives that negotiators have at their table. In the context of government formation, this weak correlation stems from two primary reasons. First, these indicators are inherently a limited subset of the numerous interrelated variables that collectively influence the viability of various potential government alternatives. Second, these indicators fail to account for the highly nonlinear and discontinuous relationship between seat distribution and the complexity of the bargaining environment. Importantly, not all seats hold equal sway, and even minor shifts in seat distribution may lead to dramatic changes in the range of feasible governing coalitions (Laver and Benoit 2015).

Two important advancements have been made to address these discontinuities. The one used most often in research on coalition formation is the approach of substituting the parties' seat shares with their respective bargaining power, as measured by a Banshaf index, when calculating the effective number of parties (see, Bergman et al. (2008) for a discussion, and Bäck et al. (2023) and Falcó-Gimeno and Indridason (2013) for applications). We will refer to this as bargaining power fragmentation.[2] A more recent advancement is that by Laver and Benoit (2015). Based on the seat shares of the three largest parties, they present a partition of all theoretically possible party systems into five basic classes with varying levels of complexity: the single winning party system, the strongly dominant party system, the top-three party system, the top-two party system, and the open system (for an application, see Ecker and Meyer 2020).

These developments represent a step in the right direction by accounting for discontinuous relationships between parties' seat share distributions and their role in bargaining. Still, the measures do so in a purely arithmetic way, with no consideration for additional constraints that ideological differences and other types of interparty relations put on which governing coalitions are likely to form.

[1]Most interest has been devoted to how complexity impacts the duration of bargaining (for example, Bäck et al. 2023; Diermeier and Van Roozendaal 1998; Ecker and Meyer 2015, 2020; Martin and Vanberg 2003), but also other outcomes have been considered, including the proportionality of cabinet portfolio allocation (Falcó-Gimeno and Indridason 2013) and the likelihood of cabinet reshuffles (Meyer et al. 2023).

[2]As elaborated by Bergman et al. (2008), in this measure, a party's bargaining power 'derives from the number of seats it holds in parliament (relative to the number of seats held by other parties) and how often the inclusion of the party turns proto-coalitions into winning coalitions. The greater the proportion of winning (majority) coalitions to which the party is crucial in forming in a given parliament, the greater the bargaining power of that party. The bargaining power scores assigned to each party are normalized such that they always sum to 1.'

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In this paper, we propose a new approach to conceptualizing bargaining complexity, which lends itself to integrating different kinds of constraints into a singular measure. The approach is based on a definition of bargaining complexity as the *amount of choice* facing the negotiating actors (rather than the number of potential bargaining outcomes) and an operationalization of bargaining complexity as the *entropy* of the selection probability distribution across potential bargaining outcomes (Shannon 1948).

In its general form, this approach is thus applicable to any negotiation context where the bargaining outcomes can be meaningfully described as a finite set of discrete alternatives, and where each potential bargaining outcome can be identified and assigned an approximate probability of realization. As a first demonstration of our approach, the remainder of the paper applies it to 343 government formation processes in twenty advanced democracies.

We first identify each potential government in each bargaining process and assign each one of them a selection probability based on predictions from a government formation model. Importantly, this model integrates both arithmetic factors pertaining to the number and size of parties, and non-arithmetic factors such as ideological dispersion, history of cooperation, and pre-electoral coalitions. Our measure of bargaining complexity is then calculated as the entropy of these probability distributions.

We then report two empirical applications of our new measure. We first demonstrate how to use the measure to disentangle between different determinants of bargaining complexity discussed in previous research. Here, we combine cross-national regression analysis with two pairwise case analyses of government formation processes in the Netherlands and Norway that compare elections with very similar arithmetic situations but very different interparty relations. Our second empirical application shows that our measure of bargaining complexity is robustly and independently related to relevant bargaining process dynamics and outcomes across countries and years.

These empirical applications are made possible by the fact that our approach is the first to provide a direct estimate of the theoretical concept of bargaining complexity *as such*, rather than some more or less closely related proxy. As elaborated in the concluding discussion, our hope is that this approach will enable new theoretical and empirical advancements in the study of political bargaining – in the government formation context and beyond.

Complexity as the Amount of Choice Facing Negotiators

The point of departure of our approach to measuring bargaining complexity is a redefinition of the theoretical concept. Although we share the intuitive understanding of bargaining complexity as being primarily about the number of viable potential bargaining outcomes that negotiating actors must consider, there are two key aspects of this instinctive definition that need further refinement before we can derive our measure of bargaining complexity.

Firstly, it is more accurate to conceive of bargaining complexity as the *amount of choice* that the involved actors face when deciding among the available alternatives rather than the sheer number of alternatives as such. This distinction is important, partly because the number of alternatives is sensitive to whether the bargaining situation is broken down into one or several decisions, and partly because the amount of choice does not increase in direct proportion to the number of alternatives.

Although a more formal elaboration of this argument follows below, let us first illustrate it using an example of a consumer shopping for milk who faces a choice between three alternatives with different fat content. In case the consumer would also need to consider that each type of milk comes in three different packaging sizes, most people would likely agree that the amount of choice has doubled – from being a single decision only about fat to being two decisions about fat and size – even though the total number of alternatives has tripled from

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three to nine.[3] Analogously, we conceptualize bargaining complexity not as the sheer number of potential bargaining outcomes but as the amount of choice that is involved in the negotiating actors' selection among the alternatives.

Secondly, alternatives (that is, potential bargaining outcomes) in political negotiations – such as potential governments, candidate lists, or agreement provisions – rarely fit neatly into binary categories of viability or non-viability. Such categorization would demand arbitrary conditions or thresholds for being counted as viable, simultaneously overlooking crucial distinctions between the most expected alternatives and the less likely but still viable options. Instead, we argue that viability is best understood as a continuous characteristic and that the relative viability of different alternative outcomes is best captured by their respective *a priori* probability of being selected. In other words, the amount of choice involved in a bargaining situation can be seen as a function of the distribution of selection probabilities across the full set of potential bargaining outcomes.

How to best define the set of potential bargaining outcomes will depend on the context and purpose of the analysis. In our current application, we follow the convention in the government formation literature and think of the potential outcomes as any unique combination of parties, or an individual party, that could end up forming the cabinet during a government formation opportunity. In other contexts, such as a negotiation around a peace agreement or a social pact in the labour market, outcomes such as impasses, delays, or breakdowns could be very relevant to include as well. As noted in the introduction, however, a precondition for our approach is that bargaining outcomes can be meaningfully described as a finite set of discrete alternatives.

Once a distribution of probabilities across potential outcomes has been established, creating a measure of bargaining complexity requires that the distribution is translated into an amount of choice. How this is best done deserves a discussion. Intuitively, bargaining complexity should be at its minimum when the outcome is certain – that is, when any one outcome has a 100 per cent probability – and increase as the probability distribution becomes less concentrated. When choosing among the large number of measures that meet these criteria, we base our decision on one of the most influential scientific papers ever written. Shannon (1948) famously stated that if we have a set of n possible, mutually exclusive events whose probabilities of occurrence, p_i, are known, and we want a measure H of how much choice is involved in the selection of the event, then it is reasonable to require the following properties of that measure:

1. H should be a continuous function of p_i.
2. If all the p_i are equal, $p_i = 1/n$, then H should be a monotonic increasing function of n. With equally likely events, there is more choice, or uncertainty, when there are more possible events.
3. If a choice is broken down into two successive decisions, the original H should be the weighted sum of the individual values of H.

Shannon then demonstrated that the only measure which satisfies these three criteria is the following, which he called *entropy*:[4]

$$H = -\sum_{i=1}^{n} p_i \log p_i \tag{1}$$

Of the criteria above, we believe that the third requires further discussion. This property is also the reason why we rule out measures based on the Herfindahl-Hirschman/Simpson indices – such

[3]A doubling occurs under the assumption that all alternatives are equally relevant (that is, that each alternative has the same selection probability). Obviously, for someone who only drinks fat-free milk the second decision would involve much more choice than the first.

[4]Political scientists have previously used Shannon's H when measuring, for example, the issue diversity of governments' executive agenda (Jennings et al. 2011) or attention diversity across policy issues in different arenas (Boydstun et al. 2014).

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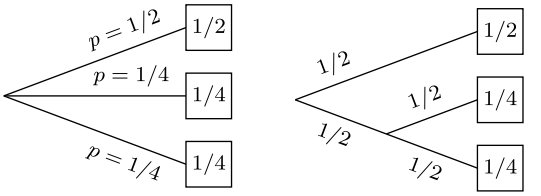

Figure 1. Decomposition of a one-shot choice into two subsets.

as, say, the 'effective number of potential governments' – and why we prefer to think about complexity as the amount of choice rather than the number of alternatives.

Consider the choice set of three alternatives depicted in Figure 1, which we can write as either a one-shot decision with the probabilities $1/2$, $1/4$, and $1/4$, or two decisions where we first choose between two probabilities each with $p = 1/2$, and if the second occurs, we make a new decision with probabilities $p = 1/2$. In a government formation context, the two-step decision process could be about first choosing between two prime minister candidates and, second, if the second candidate is chosen, deciding between two different coalitions led by this candidate. A real-world example that may illustrate this situation is the 2013 government formation process in Norway, analyzed more closely in the case study section below. After the election, four right-wing parties with a new seat majority first agreed on the Conservative party leader Erna Solberg as the preferred new prime minister and then entered into coalition bargaining that eventually resulted in a new cabinet consisting of two of the parties rather than all four.

Shannon's third criterion states that the measure should treat these two ways of selecting between the three alternatives as involving an equal amount of choice (in expectation). This is an important property since there is no way for us to know how negotiators structure their decision processes. Moreover, if we instead were to calculate the number of (effective) alternatives, as if all decisions were made in a single shot, we would systematically overestimate how much complexity increases with the number of alternatives. It is always possible to break down a large set of alternatives into smaller subsets, which explains why, in the example with the milk customer, the number of alternatives tripled (from three to nine) while the amount of choice – that is, the entropy – was only doubled, assuming all alternatives are equally relevant.[5]

In addition to the properties above, Shannon's entropy H also satisfies the following desirable criteria of any bargaining complexity measure:

1. When the outcome is certain, and only then, H is zero.
2. H is maximized when all probabilities are equal.
3. For a given concentration, H is a monotonic increasing function of n.
4. H is not affected by the addition of irrelevant alternatives ($p_i = 0$).[6]

A discussion is warranted here about the conceptual relationship between complexity as defined here and the concept of uncertainty frequently used in bargaining research. Indeed, as noted already by Shannon (1948, 392), asking how much choice is involved in the selection of an event is equivalent to asking 'how uncertain we are of the outcome' – in our case, how uncertain we are of which potential bargaining outcome will be selected. By contrast, when uncertainty is used in previous research it primarily refers to negotiators' lack of information about various parameters of relevance to the bargaining situation, such as the preferences or perceptions of prospective coalition partners or of voters (De Winter and Dumont 2008; Diermeier and Van Roozendaal 1998; Falcó-Gimeno and Indridason 2013; Golder 2010). While related, these two

[5]Entropy increased from 1.6 to 3.2 using a logarithm with base 2.

[6]This criteria rules out many measures of inequality, such as the Gini coefficient.

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factors are clearly distinct, as an increase in *bargaining parameter uncertainty* only leads to higher *bargaining outcome uncertainty* (that is, complexity) if it makes the most probable coalitions less likely to form.

Our Approach Applied to Government Formation

To empirically assess the validity of our approach, we apply it to 343 government formation processes in twenty parliamentary or semi-presidential Western democracies between 1960 and 2023, as recorded by Döring et al. (2023, see Section S1 in the Supplementary Material for details). We choose to focus on the intricacies of bargaining related to government formation as it is in this literature that bargaining complexity has recently garnered the most attention.

A demanding aspect of our approach is that it requires not only that the potential outcomes are identified but also that these alternatives are weighted based on their respective probability of realization. While such weights can be chosen arbitrarily by the researcher, we believe there are strong reasons to model the selection probabilities carefully.

As we argued in the introduction, two important limitations of the common approach in legislative studies of operationalizing bargaining complexity with a few proxy indicators – such as the ones based on the number of involved actors – is that these are insufficient for approximating the number of viable potential bargaining outcomes at hand, and that they tend to also be compatible with competing mechanisms or explanations for outcomes such as bargaining delays and other problems (Martin and Vanberg 2003; Zhang et al. 2021).

If we instead operationalize bargaining complexity by estimating the selection probabilities of the potential bargaining outcomes, we can consider a much wider range of variables that affect the likelihood of one or the other alternative. In the context of government formation, such variables include the potential governments' size, ideological composition, cooperation experience, etc. At the same time, these variables will only impact our measure of bargaining complexity to the extent they affect the probability distribution of the potential governments, thereby keeping bargaining complexity both conceptually and empirically distinct from related concepts that are also associated with the same variables, such as preference uncertainty or commitment problems.

The first step in producing such an operationalization of bargaining complexity is to identify the full set of conceivable bargaining outcomes available to the negotiators. In the case of government formation, this refers to each potential government, meaning each unique combination of parties, or an individual party, that could end up forming the cabinet during a government formation opportunity. The number of potential governments grows exponentially with the number of parties in the parliament, such that with n parties, the sum equals $2^n - 1$ (Martin and Stevenson 2001).

The second step in our operationalization is to estimate a model of the bargaining process, which is used to predict a probability of selection for each potential bargaining outcome. In our present application, we apply the potential government framework introduced by Martin and Stevenson (2001), in which the government formation process is modelled as a discrete choice problem where the parties in the legislature select one of the potential governments among those in the full choice set. The outcome of this exercise is a model that may predict, for each of the potential governments available in a given formation opportunity, a probability of selection based on a number of variables capturing characteristics of that coalition. As described in more detail below, these variables are based on the observed characteristics of the parties in the legislature, including their seat share, ideological profile, governing experience, different types of relationships with other parties, and other factors with relevance to their position in bargaining. For each government formation, the sum of predicted probabilities of realization across the potential governments equals 1.

To accurately estimate the relative viability of each potential government, our government formation model incorporates a wide array of factors affecting each government's selection

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probability. Most of the variables revolve around the size and ideological proximity, pre-electoral relationships, and incumbency status of the parties in the potential government and are adopted from previous research using the same modeling framework (for a summary and evaluation of variables used in previous studies, see Cronert and Nyman 2021). However, since our model's primary aim here is prediction, we are not confined to using only theoretically relevant or conceptually distinct variables. This approach enables us to build a model with greater explanatory power. Below, we outline how our model advances beyond existing research.

First, most coalitions form between parties that are ideologically aligned with respect to dominant issues on the political agenda. Previous studies have generally measured this ideological proximity through parties' left–right stances and, sometimes, their historical alliances. Although these metrics effectively capture traditional political divides, they falter when it comes to abrupt shifts in the political landscape. For instance, they are inadequate for explaining phenomena like the austerity debates in Greece or the splintering of the Swedish right-wing alliance over the Sweden Democrats. To address this, our model complements the standard indicators of left–right positions with data 1) on pre-electoral coalitions (Bergman et al. 2021; Hellström and Bäck 2021), a binary indicator for coalitions that dissolved during the preceding election cycle, and 3) party-dyadic like–dislike scores derived from surveys with party supporters from the Comparative Study of Electoral Systems (CSES 2020, 2023).

Second, minority governments come in different flavours. Prior research using the potential government framework has primarily categorized these governments by their internal cohesion and the ideological range of the opposition. However, the viability of a minority government hinges on multiple factors, and we have added variables capturing the following: whether an investiture rule applies that requires support from an absolute majority in parliament (Cheibub et al. 2021), whether the minority coalition controls the median seat, whether it controls the median seat when populist parties (Rooduijn et al. 2023) are excluded, and the characteristics of their most likely parliamentary majority. For the latter, we compute both the minimum ideological range and the maximum like–dislike scores for the combination of parties needed to secure a majority.

Third, beyond addressing interparty relations and the intricacies of minority governments, we have also fine-tuned the model in other ways. For example, we have relaxed the assumption that the number of parties in a potential government has a linear impact on its probability of forming the government by instead including them as fixed effects. We also introduce some theoretically informed interaction effects, such as allowing the impact of an extra seat to vary between minority and majority coalitions and the impact of historical cooperation to decrease in the presence of explicit pre-electoral agreements.

For a complete list of variables included in the model, see Table 1. In line with most existing literature, we model the government formation process using a conditional logit model, where the probability $p(O)$ that the potential government j is chosen out of the set of J potential governments in the formation opportunity occurring in country i after election y is:

$$p(O)_{jiy} = \frac{e^{\beta' x_{jiy}}}{\sum_{j=1}^{J} e^{\beta' x_{jiy}}} \tag{2}$$

Here, β represents a vector of coefficients and x_{jiy} is a vector of variables associated with potential government j in formation opportunity iy.

To conserve space, the full model output is reported in the Supplementary Material (Table S2). However, it is worth noting that partly because of the addition of the new variables, and partly because of several smaller tweaks to the model, our model performs rather well in terms of predicting what coalition is eventually selected into government office by parliament. The Pseudo R^2 parameter is at 0.68, which is higher than those reported in previous studies, especially so on

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Table 1. Potential government variables included in the model

Variables related to ideology	Seat share squared
Ideological range	Excess seat share squared
Opposition ideological range	Electoral performance
Connected	Minimal-winning coalition
Median party	Largest party
Ideological distance to median	Single-party majority
Seat share of conservative parties	
Dominated by conservative parties	*Other party characteristics*
	Pre-electoral coalition
Variables related to previous cooperation	Pre-electoral coalition with majority
Number of incumbent parties	Populist party
Incumbent government	Dyadic like–dislike
Incumbent prime minister	Dyadic like–dislike squared
Party left cabinet	Like–dislike for most disliked party
Party cabinet history	Disliked party
Dyadic cabinet history	Dependent on a populist party
Variables related to party size	*Combinations of variables*
Number of parties	Largest bloc dependent on a populist party
Seat share	Seat share of conservatives if dependent on p.p.
Excess seat share	Highest like–dislike score in parl. majority
Minority cabinet	Ideological range of parl. majority
	+ selected interaction variables

cross-national samples from Western Europe (see Cronert and Nyman 2021).[7] However, well-known differences in coalition formation dynamics between, for example, Western and Eastern Europe (for example, Savage 2016) suggest that the present model may require adjustments to perform effectively in other contexts.

Having estimated the model, we use it to predict a probability of selection p_i for each of the n potential governments in the sample. The final step of our procedure is to calculate the entropy of the distribution of predicted probabilities for each government formation process, following Equation 1 above. The resulting score represents our measure of bargaining complexity.

Empirical results

Investigating the Determinants of Bargaining Complexity

To provide a first overview of our new measure, we begin by investigating how it varies across countries. Figure 2 reports the average level of entropy over the period 1960–2023 for each country in our sample (see Figure S1 for election-specific estimates). It is clear that there is a considerable degree of variation, with average entropy ranging from 0.43 in Greece to 3.8 in Italy. Also clear from the figure is the systematic relationship between entropy and the electoral system. Out of the six countries where a majoritarian or mixed electoral system (rather than a proportional representation system) has been the most prevalent system over this period – Australia, Canada, France, Germany, New Zealand and UK – five are among the seven countries with lowest average entropy scores, with France being the sole exception at rank nine of twenty.

The relationship between electoral systems and entropy can also be demonstrated in a regression analysis. To that end, Column 1 in Table 2 reports an OLS regression run on the full 1960–2023 sample where the entropy score is regressed on a set of dummy variables differentiating between PR systems, majoritarian systems, and mixed systems (with PR systems

[7]The Supplementary Material also reports analyses demonstrating that (1) our operationalization performs well when the coalition formation model is simplified to the fourteen most important variables (Section S3), but (2) performance drops considerably if only arithmetic variables related to the number and size of parties are included (Section S4).

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Table 2. Determinants of bargaining complexity

	(1)	(2)	(3)	(4)
Majoritarian electoral system	−1.27***	−0.12	−0.17	
	(0.12)	(0.10)	(0.11)	
Mixed electoral system	−0.75***	0.08	0.06	
	(0.23)	(0.14)	(0.12)	
Year	0.01***	−0.01**	−0.01**	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Number of parties		0.18***	0.18***	0.16***
		(0.02)	(0.02)	(0.04)
Effective number of parties		0.18**	0.20**	0.10
		(0.09)	(0.09)	(0.10)
Bargaining power fragmentation		0.25***	0.19***	0.19***
		(0.05)	(0.05)	(0.06)
Majority-winning incumbent government			−0.67***	-0.62***
			(0.09)	(0.10)
Majority-winning PEC			−0.45**	−0.48**
			(0.21)	(0.21)
Non-majority-winning PEC			−0.29	−0.41*
			(0.18)	(0.22)
Unweighted ideological dispersion			−0.31***	−0.17
			(0.11)	(0.15)
Seat share–weighted ideological dispersion			0.42***	0.33*
			(0.14)	(0.17)
Constant	1.63***	−0.89***	0.28	0.30
	(0.15)	(0.19)	(0.33)	(0.36)
Observations	343	343	343	343
Adj. R^2	0.16	0.63	0.69	0.73
Country FE	No	No	No	Yes

Robust standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

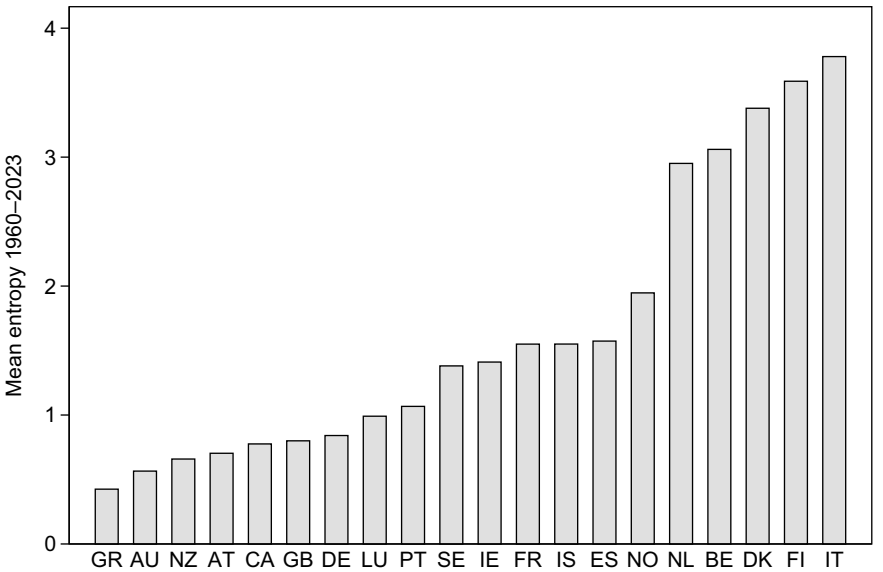

Figure 2. Bargaining complexity across countries.
This bar graph shows how our measure of bargaining complexity differs between countries. The estimates are averages over the period 1960–2023.

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being the reference category), as well as a continuous linear variable representing time.[8] For descriptive statistics pertaining to this analysis, see Table S3 in the Supplementary Material. The model confirms that mixed and majoritarian countries have considerably lower entropy scores than PR countries. It also confirms that bargaining complexity has seen an increasing trend on average during this period.

Columns 2 and 3 in the table yield additional insights into the determinants of bargaining complexity. First, Column 2 confirms the common understanding that the impact of the PR system and the increasing time trend in bargaining complexity are mediated through the party system arithmetic. As indicators for the number of parties, the effective number of parties, and bargaining power fragmentation are added to the model, the coefficients pertaining to electoral systems move close to zero, and the coefficient for time even flips signs compared to Column 1.

However, as demonstrated in Column 3, our measure of bargaining complexity is not a function of the number and size of parties alone. This model adds variables meant to capture relevant relationships among parties, for some of which it is not evident from previous research what to expect.

The first factor of interest is whether the parties in the incumbent governing coalition jointly won a seat majority. In principle, in such cases, the incumbent coalition will obviously be just one out of numerous potential majority coalitions that negotiators could consider. However, due to various sources of incumbency advantage in government formation documented in previous research (see Martin and Stevenson 2010), we should expect that incumbent coalition parties will be likely to desire a continued cooperation, thereby reducing bargaining complexity.

A second factor of interest is formally announced pre-electoral coalitions (PECs). In the existence of a PEC that wins a seat majority, (post-electoral) bargaining complexity will be considerably lower than otherwise since the party constellation in question will emerge as the obvious first-order alternative in negotiations (Blockmans et al. 2016). What happens if that same pre-existing constellation fails to reach a seat majority is more of an open question (Bäck et al. 2023). If the parties in the PEC are coordinated enough to participate in negotiations as a unitary actor – for instance, by reaching out jointly to prospective additional coalition partners or support parties – bargaining complexity will be lower than if it had not existed. However, if, instead, the parties in the PEC need to split up, mistrust or conflicts may be spurred that, by contrast, make the bargaining landscape more difficult to navigate. To assess these expectations, we include two indicators capturing majority-winning and non-majority-winning PECs as recorded in a special version of the Western Europe PAGED dataset (Hellström and Bäck 2021) generously shared with us.

A third factor to consider is the ideological dispersion among the parties in the legislature. Here too, it is not obvious what relationship to expect(Bäck et al. 2023; De Winter and Dumont 2008; Falcó-Gimeno and Indridason 2013). Generally speaking, ideological dispersion should reduce bargaining complexity, as the number of viable coalitions decreases when ideologically disparate coalitions can be ruled out in favour of more coherent coalitions. This is the primary reason why coalition formation is more predictable in ideologically polarized multi-party systems than what the number of parties may suggest, as well as why the entrance of an extreme party does not necessarily increase bargaining complexity if no one is willing to cooperate with the new party.

However, if the ideologically extreme party grows large enough, it may be hard for negotiators to rule it out as a partner. In that case, ideologically adjacent but more moderate parties will face a more difficult choice of whether to seek cooperation towards the extreme or across the centre. This would result in *higher* bargaining complexity in the sense that the presence of the extreme party has increased the number of viable alternatives.

To distinguish between these two potentially counteracting mechanisms, the model includes two related but distinct measures. The first measure represents the standard deviation of the

[8]The variable is labeled 'year' as it is defined as the date divided by 365.

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left–right positions among all parties represented in the parliament. The second is a residualized version of the first measure that weighs each party according to its seat share. The logic behind combining the two measures is that in the presence of the unweighted measure, all unique variation in the weighted measure is based on the relative size of parties. Consequently, while the unweighted measure captures how far apart the parties are located on the left–right spectrum, the residual variation in the weighted measure captures the strength of ideologically extreme parties relative to that of centrist parties.

Unlike measures based on the seat share distribution in the legislature, such as bargaining power fragmentation, our measure of bargaining complexity is designed to incorporate a broad spectrum of interparty relations and their interactions with the seat shares held by each party. It is thus reassuring that we see a 6 percentage point increase in the explanatory power of the regression model between Column 2 and Column 3. The results suggest that both majority-winning incumbent governments and PECs reduce bargaining complexity, although the coefficient for minority PECs is not precise enough to reach statistical significance.

As to ideological dispersion, the analysis supports both mechanisms: The negative effect of the unweighted measure indicates that a broader ideological spread among all parties is associated with reduced bargaining complexity, likely because ideologically incompatible coalitions can be more easily excluded. Conversely, the positive effect of the seat-weighted measure suggests that when ideologically extreme parties grow larger, bargaining complexity increases. Presumably, this is because their sheer size makes them difficult to ignore, forcing the mainstream parties to either join forces with the extreme party or cooperate with their former adversaries.

Column 4, lastly, adds country fixed effects to the model. The results clearly suggest that both types of factors – those related to the number and size of parties and those related to parties' pre-existing relationships – also help account for variations in entropy within countries over time.

Illustrative Case Analyses

To further elucidate the intuition behind our understanding of bargaining complexity and to illustrate the added value of our measure over purely arithmetic measures, we will next briefly consider two pair-wise case comparisons focusing on different types of non-arithmetic factors influencing bargaining complexity. Having reviewed the patterns in our dataset (see Figure S1), we have chosen adjacent cases that have very similar arithmetic situations but deviate markedly with regard to important interparty relationships.

Netherlands 1982–1986: Incumbency advantage and previous cooperation

The first comparison highlights the role of the incumbency advantage and of parties' experience of governing together, two factors not accounted for in arithmetic models of bargaining complexity. The governing formation processes chosen to illustrate these factors are those taking place after the 1982 and 1986 elections in the Netherlands. As reported in Table 3, the outcomes of these two elections are very similar in arithmetic terms. The effective number of parties, as well as the bargaining power fragmentation scores and the relative strength of the three largest parties – CDA, PvdA, and VVD – are very similar, and both cases are accordingly categorized as top-three party systems according to the Laver and Benoit (2015) classification. Nevertheless, the entropy score of 3.0 that our model ascribes to the 1982 election is three times higher than that of the 1986 election. A closer look into the interparty relationships helps us better understand why negotiators faced so many more choices regarding the composition of the government after the 1982 elections.

Up until four months before the 1982 election, the Netherlands was governed by a three-party cross-cutting coalition between the Christian democratic CDA, social democratic PvdA, and the liberal D66 (Van Agt II). On April 12, PvdA, who had recently suffered a dramatic setback in the provincial elections, decided to leave the government over a disagreement about

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Table 3. Comparing Lubbers I and Lubbers II in the Netherlands

	High-entropy case	Low-entropy case
Election	1982 (Sept 8)	1986 (May 21)
Incumbent coalition	CDA + D66 (*Van Agt III*)	CDA + VVD (*Lubbers I*)
Top three parties (seat share)	PvdA (31%) CDA (30%) VVD (24%)	CDA (36%) PvdA (35%) VVD (18%)
Effective number of parties	4.0	3.5
Bargaining power fragmentation	3	3
Laver & Benoit (2015) system	Top-three party system	Top-three party system
Entropy	3.0	1.0
Pre-electoral coalition	None	None
Most likely coalition	CDA + VVD (26%)	CDA + VVD (79%)
Second most likely coalition	CDA + PvdA (17%)	CDA + PvdA (8%)
Third most likely coalition	PvdA + VVD (14%)	PvdA (3%)
Winning coalition	CDA + VVD (*Lubbers I*)	CDA + VVD (*Lubbers II*)
Bargaining duration	57	54
Bargaining rounds	2	1
Parties leaving bargaining	2	0

cuts in government spending. After the government had fallen, CDA and D66 formed a caretaker government (Van Agt III) primarily tasked with organizing early elections (Parlement.com 2024a).

The September 1982 elections resulted in a 2 percentage point gain in the seat share of PvdA, making it the largest party at 31 per cent. The incumbent parties CDA and D66 lost 3 and 7 percentage points of the seats, respectively, while the liberal VVD was the biggest winner, gaining almost 7 percentage points of the seats. With no obvious coalition emerging from these results, PvdA, as the largest party, was the first to be appointed as an informant with the task of investigating the possibilities of forming a cabinet. Beginning on September 10, its informant, Jos van Kemenade, examined the possibilities of a majority cabinet of PvdA and CDA, possibly joined by D66, as well as PvdA and VVD. While the latter option was immediately rejected by VVD, negotiations were soon initiated between the PvdA, CDA, and D66 (Parlement.com 2024b).

However, the three former coalition partners failed to reunite. Burdened by the personal animosity between the two party leaders (CDA-Digitaal 2024) – Dries van Agt of CDA and Joop den Uyl of PvdA, who served as Deputy Prime Minister in van Agt's second cabinet at the time of PvdA's departure – their negotiations failed as the programmatic differences between the parties were deemed to large. After three weeks, on October 1, the informant appointment was instead handed over to CDA, who succeeded in negotiating a coalition agreement with VVD. On October 30, CDA's parliamentary leader Ruud Lubbers was appointed as formateur, and five days later, his first cabinet was sworn in, fifty-seven days after election day.

Although the ensuing years were troubled by economic and social turbulence in the Netherlands, the Lubbers I cabinet completed its four-year term, and ahead of the 1986 elections the CDA–VVD coalition declared that it wanted to 'finish the job' (Parlement.com 2024c). The main consequences of the 1986 election were a 6 percentage point gain in the seat share of CDA and an equally large loss for VVD. Consequently, the arithmetic situation in the parliament saw very little change. Nevertheless, this time, the bargaining situation was much less complex since the incumbent coalition parties were both willing and able to govern anew – a difference also reflected in the much higher governing probability assigned by our model to the CDA–VVD coalition in 1986. Accordingly, the formation process of Lubbers II went smoothly, and it turned out quite easy for the informant to resolve any problems standing in the way of continued cooperation (Parlement.com 2024c).

Interestingly, this doesn't imply that the formation process was shorter; indeed, fifty-four days passed between the election on May 12 and the swearing in of new ministers on July 14. It is worth

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Table 4. Comparing Stoltenberg II and Solberg I in Norway

	Low-entropy case	High-entropy case
Election	2005 (Sept 12)	2013 (Sept 09)
Incumbent coalition	H + KrF + V (*Bondevik II*)	DNA + SV + Sp (*Stoltenberg II*)
Top three parties (seat share)	DNA (36%)	DNA (33%)
	FrP (22%)	H (28%)
	H (17%)	FrP (17%)
Effective number of parties	4.6	4.4
Bargaining power fragmentation	4.1	4.0
Laver & Benoit (2015) system	Top-two party system	Top-two party system
Entropy	1.1	3.3
Pre-electoral coalition	Majority-winning	Non-majority-winning
Most likely coalition	DNA + SV + Sp (79%)	H + FrP + KrF (18%)
Second most likely coalition	DNA + FrP (4%)	DNA + H (15%)
Third most likely coalition	DNA (2%)	H + FrP + V (10%)
Winning coalition	DNA + SV + Sp (*Stoltenberg II*)	H + FrP (*Solberg I*)
Bargaining duration	35	37
Bargaining rounds	1	2
Parties leaving bargaining	0	2

noting, however, that the 1986 coalition agreement was much more comprehensive than the 1982 agreement, both in terms of its length (almost 20,000 words compared to 7,000) and in terms of the number of policy statements it conveyed (950 quasi-sentences compared to 298 according to data from Klüver et al. 2023).

Norway 2005 and 2013: Pre-electoral coalitions

Our second case study compares the 2005 and 2013 elections in Norway, which – like in the Dutch case above – are very similar from an arithmetical point of view. As summarized in Table 4, both are categorized as top-two party systems, and they are almost equal in terms of their effective number of parties and bargaining power fragmentation. However, whereas the aftermath of the 2005 election was characterized by very low entropy and a highly certain bargaining outcome, the 2013 election resulted in a much more complex and unpredictable formation process. This difference is best understood with reference to how pre-electoral coalitions may impact coalition bargaining dynamics.

The 2005 elections in Norway marked the end of the right-wing Bondevik II government, made up by the conservative Høyre (H), the Christian democratic Kristelig Folkeparti (KrF), and the liberal Venstre (V). Leading up to the election, a new pre-electoral coalition was established between the Labour Party (DNA), the Centre Party (Sp) and the Socialist Left Party (SV) with the aim of forming a centre-left majority government. This was the first time in the post-war era that the DNA entered into a pre-electoral coalition and the first time that the Sp opened up for governing with the parties on the left (Sitter 2006).

The election on September 12 resulted in a major loss for the incumbent government and a slim seat majority for the new coalition. With the three parties already having committed to forming a government, preparations for bargaining began immediately. Negotiations started on September 23, and a coalition agreement was presented on October 17. Four days later, the new coalition government was sworn in, with DNA party leader Jens Stoltenberg as prime minister.

The three coalition parties retained their majority in the 2009 elections, and the Stoltenberg cabinet kept governing. In the 2013 elections, however, all three parties suffered major setbacks as the four opposition parties on the right – H, KrF, V, and the right populist Progress Party (FrP) – won a 56 per cent seat majority (Döring et al. 2023).

This change of tides paved the way for a new right-wing government but the composition of said government was not obvious. A majority government – the preferred alternative by Høyre's prospective Prime Minister Erna Solberg – would require that H and FrP were joined by at least

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one of the two other parties. Yet, although the four parties had collaborated significantly in parliament, FrP had not previously participated in government; and, whereas FrP had declared before the election that they would refuse to support a government, they are not part of themselves; both KrF and V had made it clear that they deemed governing with FrP unlikely (NRK 2013a,b). Also, the two parties had committed to either enter government together or remain outside together (Allern and Karlsen 2014).

In any event, negotiations between all four parties began on September 16. On September 30, a five-page 'cooperation agreement' between all parties was presented to the media and to the parliament. In addition to a set of specific policy compromises, the agreement stated that FrP and H would pursue negotiations aimed at forming a government supported by V and KrF and that they would be positive towards V or KrF entering the government later if they would so desire (Venstre 2013). The government negotiations between H and FrP concluded one week later, and, on October 16, the Solberg I minority government assumed office. For FrP – like for SV eight years earlier – this meant participating in government for the first time in the party's history.

In sum, comparing these two elections illustrates how, despite similar arithmetic results, the absence of a pre-electoral coalition in the 2013 election left the negotiating actors with much more choice regarding the cabinet composition. While, again, this did not particularly prolong the formation process, it led to more bargaining rounds involving more parties and even resulted in an agreement that explicitly left the question of what parties to include in the cabinet open to future renegotiation. Indeed, both V and KrF did join the government in 2018 and 2019, respectively, and in 2020, FrP withdrew from the government while maintaining its support for Solberg as Prime Minister. These events further underline the complexity of the bargaining environment characterizing the eight years that Solberg remained Prime Minister.

Predicting Observable Bargaining Characteristics and Outcomes

Our primary claim to measurement validity is based on (1) the theoretical closeness between our measure of entropy and the uncertainty about the expected bargaining outcome, and (2) on our estimation procedure that models the complex interplay of factors expected to influence that uncertainty. Nevertheless, if one believes that bargaining complexity will affect negotiation dynamics, it should follow that some predictive power with respect to directly observable characteristics or outcomes of the bargaining process should be a desirable feature of any measure of bargaining complexity. Which such observable characteristics and outcomes are most relevant, however, is not a straightforward question. As noted above, most previous work on legislative bargaining complexity has been devoted to understanding how bargaining complexity affects the duration of bargaining; indeed, some even use bargaining duration as a proxy for bargaining complexity (for example, Meyer et al. 2023).

However, in our view, focusing solely on the total duration of the bargaining process has two disadvantages. First, the measure arguably yields rather limited information about what actually goes on during the negotiations. Second, bargaining duration might not be as closely linked to bargaining complexity as commonly presumed. This is because, as the bargaining situation grows more complicated, there is an increased likelihood that major portions of the negotiations will be deferred until after the cabinet has taken office. The difference in the scope of the coalition agreements negotiated after the 1982 and 1986 Dutch elections, reviewed above, may illustrate this point. As another example, if the formateur perceives forming a majority coalition as an insurmountable challenge, he or she may opt for a minority cabinet instead. This strategic shift would fundamentally alter the nature of negotiations: instead of taking place between potential coalition partners prior to forming the government, bargaining would then occur between the government and parliament at a later stage. Hence, the bargaining duration would be relatively short, but only because most of the bargaining is, in a sense, postponed.

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Table 5. Predicting observable bargaining characteristics and outcomes

	Bargaining duration		Bargaining rounds		Excess bargaining scope		Cabinet duration	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Entropy	10.66***	4.01	0.40***	0.34***	6.10***	4.60***	−72.41***	−65.11**
	(2.90)	(3.86)	(0.08)	(0.12)	(1.13)	(1.67)	(17.36)	(32.21)
Number of parties		−0.11		0.05		−0.18		21.00
		(1.55)		(0.07)		(1.11)		(18.45)
Eff. num. of parties		15.36***		0.13		3.18		−49.90
		(5.80)		(0.19)		(3.44)		(56.05)
Barg. power fragm.		−1.82		−0.01		1.61		−27.97
		(1.63)		(0.10)		(2.15)		(33.98)
Year		−0.02		−0.01		−0.14		5.11***
		(0.11)		(0.01)		(0.11)		(1.83)
Constant	18.50***	−23.96**	1.01***	0.99**	1.10	−1.15	1096.22***	805.56***
	(3.53)	(12.16)	(0.12)	(0.42)	(1.71)	(8.08)	(36.71)	(109.99)
Observations	343	343	237	237	237	237	327	327
Adj. R^2	0.11	0.42	0.15	0.26	0.14	0.15	0.04	0.14
Outcome mean	36.03	36.03	1.75	1.75	12.35	12.35	978.83	978.83
Country FE	No	Yes	No	Yes	No	Yes	No	Yes

Robust standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Having said that, we still find it worthwhile to investigate to what extent bargaining complexity, on average, is able to predict the overall bargaining duration.[9] However, we will also consider its predictive capacity with regard to two additional observable bargaining process characteristics that, in our view, yield more information into the actual bargaining dynamics. The first such measure is the total *number of bargaining rounds*, including failed rounds, that are needed before a governing coalition has been formed. Higher uncertainty regarding the bargaining outcome implies that a larger share of the potential governments are likely to be deemed viable alternatives by negotiators, and we should thus expect that more negotiation attempts need to be made by different potential governments before the winning coalition is identified.

The second, related but distinct measure is the *excess bargaining scope*, which captures the share of those parties that participated in at least one bargaining round during the government formation process, who did not become part of the government. The rationale behind this indicator is analogous to the previous measure but focuses on parties that were considered but set aside instead of potential governments that were considered but set aside. With higher bargaining complexity, for every party that is eventually included in a governing coalition, the number of alternative parties that were deemed as a potential viable partner at some point in the process should be higher; that is, the excess scope of the bargaining should be larger.

In addition, we consider a measure of the cabinet duration, defined simply as the number of days between the cabinet's entry into office and its termination. When entropy is higher – that is, when there are alternative potential cabinets, other than the one in office, that had a fairly high probability of selection – we might expect that a stochastic change in some important interparty relationship during the cabinet's time in office is more likely to trigger a government breakdown or modification compared to when no viable alternatives exist.

The results are reported in Table 5. For each of our four measures, we report one bivariate model, and one model that puts our measure to a test by including a number of previous bargaining complexity measures as well a full set of country dummies and a time trend. Beginning with the number of bargaining rounds, a one-unit increase in entropy is associated with 0.40 additional rounds, corresponding to 23 per cent of the sample average. For the excess scope of

[9]We define duration as the number of days between the election and the day when the government is sworn in or officially takes office. If these are the same, we set the duration to the smallest non-zero value for that country.

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bargaining, a one-unit increase in entropy is associated with a 6.1 percentage point higher share of parties that were involved in negotiations but ultimately set aside. This amounts to close to 50 per cent of the sample average.

Including the additional variables and country dummies shrinks the coefficients for entropy, but the associations remain substantive and significant. Another noteworthy pattern is that the party system-based measures and country dummies help account for only a limited proportion of the variance in these outcomes, as indicated by the modest changes in the Adjusted R^2 parameters between models, especially so for the excess scope of bargaining.

With regard to bargaining duration, there is likewise a substantial bivariate association with entropy. However, when the additional variables enter the model, this coefficient drops by more than 60 per cent and falls below significance, while the adjusted R^2 increases substantially. One possible interpretation of this finding is that the country dummies and party system-based measures, to a large extent, capture factors that increase the risk for bargaining delays *in other ways* than by impacting the probability distribution of potential bargaining outcomes. For instance, the addition of a new party to a negotiation may not only increase bargaining complexity as defined here, but it may also boost uncertainty about actors' preferences, create a need for more time-consuming communication and decision processes, and make strategic logrolling more difficult to achieve (for example, see Zhang et al. 2021). In other words, we might not be surprised to find that bargaining duration is not primarily a function of the amount of choice facing negotiators.

Turning to the last two columns, a one-unit increase in entropy is associated with a 72-day shorter cabinet duration on average or slightly less when the additional variables are included. This finding supports the notion that cabinets become more fragile and short-lived when the involved parties have other viable alternatives to consider as they go along.

Summarizing the findings in this section, it is clear that, compared to existing party system-based measures, bargaining complexity operationalized as entropy does a relatively better job at accounting for those observable outcomes that are more closely linked to the actual dynamics of bargaining than to its overall duration, and it shows a robust negative association with the longevity of the resulting cabinet.

There are, however, two more general takeaways from these exercises. First, as illustrated by the large variation in how well the full model performs on the four bargaining characteristics, these variables measure very different things. Indeed, for the standardized versions of the four variables, Cronbach's alpha scale reliability coefficient is not higher than 0.6. Furthermore, supplementary analyses that compare the predictive capacity of ours and previous bargaining complexity measures, one by one, show that those who best predict excess bargaining scope and cabinet duration perform worse than others at predicting bargaining duration and the number of bargaining rounds (see Supplementary Material, Section S5). Second, it is only by quantifying bargaining complexity directly, as we have done here, that we are able to assess its importance relative to other factors in the first place. These points, in our view, are important to consider in future research on political bargaining, also in contexts beyond government formation negotiations.

Concluding Discussion

In this study, we have proposed a new approach to conceptualizing and estimating bargaining complexity that moves beyond the measures used in earlier research that are based either a) solely on arithmetic constraints facing negotiators or b) on remote proxies such as the bargaining duration. We have argued that bargaining complexity is best conceptualized as the *amount of choice* facing the negotiating actors, rather than the number of potential bargaining outcomes at the table, and best operationalized as the *entropy* (Shannon 1948) of the probability distribution across potential bargaining outcomes.

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Our hope is that this approach will enable both theoretical and empirical advancements in the study of political bargaining. In terms of theory, our conceptualization helps by providing a better foundation for discussions regarding the potential causes and consequences of bargaining complexity. Empirically, our operationalization of bargaining complexity allows for investigating such questions more precisely than before and to disentangle complexity from adjacent but distinct factors that potentially impact negotiations, such as the number of involved actors or actors' uncertainty regarding various bargaining parameters.

Crucially, statistical analysis that includes both bargaining complexity and adjacent concepts would not be feasible without a direct quantification of the theoretical concept of interest *as such* – something we have aimed to achieve here. For example, we anticipate that our measure will be valuable in analyzing the determinants of bargaining complexity, assessing its importance relative to other factors in explaining various outcomes, and serving as a benchmark indicator in case studies of bargaining processes. These are all areas where proxies, such as the effective number of parties or bargaining power fragmentation, fall short because they can also refer to other concepts, like party system fragmentation.

We have presented a first application of the new approach to 343 government formation processes in advanced democracies, using a potential government framework that allows for the probability distribution across potential governments to be impacted both by arithmetic constraints related to the number and size of parties, and by interparty relations as well as complex interactions between the two.

We then showed how to use this measure to assess and disentangle between different determinants of bargaining complexity, including pre-electoral coalitions and ideological dispersion, for which the expectations from previous research vary. We furthermore demonstrated that bargaining complexity is robustly and independently related to relevant bargaining process characteristics and outcomes, including the number of bargaining rounds, the excess scope of the negotiations, and the longevity of the resulting cabinet. At the same time, we have sought to problematize the notion of a straightforward link between bargaining complexity and bargaining duration, posited in most previous literature.

Like any other approach, ours has certain disadvantages. Whereas the intuition for why we need to consider the probability distribution of potential bargaining outcomes should be fairly straightforward, our preferred approach for estimating these probabilities is admittedly computationally challenging and data demanding. However, scholars do not necessarily have to produce those estimates themselves but could retrieve them fairly directly from the replication files of this or previous studies estimating the probabilities of government formation outcomes (for example, Cronert and Nyman 2021; Kayser et al. 2023). Furthermore, from this point of view, it is reassuring to note that very similar results appear in a set of supplementary analyses where the government formation model underpinning our bargaining complexity measure only includes a subset of fourteen variables that are easy to calculate and readily available (Supplementary Material, Section S3).

Yet, by contrast, a second set of supplementary analyses demonstrates that bargaining complexity is prone to overestimation if we instead use a purely arithmetic model based solely on the factors related to the number and size of parties on which previous measures are based (Section S4). When assessing the viability of the different potential governments, such models cannot discriminate between historically common coalitions among ideologically adjacent parties and improbable coalitions between fierce adversaries. This underscores the importance of also considering non-arithmetic factors when analyzing bargaining complexity in a government formation context.

In its general form, the approach proposed here is, however, not limited to government formation bargaining. Future research may want to explore similar applications in other negotiation contexts where the bargaining outcomes can be meaningfully described as a finite set of discrete alternatives and where each potential bargaining outcome can be identified and

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assigned an approximate probability of realization. Such contexts may include, for instance, the allocation of a set of cabinet portfolios among coalition partners, the composition of the candidates that an election committee places at the top tier of a party ballot in a list PR system, or the set of provisions in a peace agreement. As to the latter example, peace and conflict scholars may analyze the complexity of peace negotiations by treating each possible combination of provisions – such as electoral reforms, regional autonomy, or prisoner releases – as a set of potential outcomes. The relative probabilities of these outcomes can then be estimated using data on key conflict issues (for example, rebel demands) and the characteristics of both the conflict and the negotiating actors. Such analysis could provide new insights into how the complexity of peace negotiations is influenced by factors such as international mediation, the conflict's issue dimensionality, and the relative military strength of the warring parties.[10]

The approach needed to identify the potential bargaining outcomes and to estimate their probabilities of realization in the aforementioned contexts will evidently differ from the government formation context analyzed here. However, a key takeaway from our present exercise should be generally applicable, namely that there are good conceptual and statistical reasons to think of bargaining complexity in terms of the uncertainty about the bargaining outcome and to operationalize it as the entropy of the potential outcomes.

Supplementary material. For supplementary material accompanying this paper visit https://doi.org/10.1017/S0007123425000109

Data availability statement. Replication data for this article can be found in Harvard Dataverse at https://doi.org/10.7910/DVN/URUCHI.

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