CABINET FORMATION IN COALITION SYSTEMS

Fabrizio Carmignani[1]

Department of Economics Glasgow University
Department of Economics State University-Milan

Abstract

This paper investigates the issue of cabinet formation in coalition systems as a necessary step towards the understanding of economic policy formation. A theoretical model of political bargaining based on the war of attrition approach is proposed. This model is then compared to two alternative models of political bargaining based on more traditional approaches. This comparison is undertaken through an empirical test of the main propositions derived from each theoretical model. The empirical analysis highlights interesting results related to the duration and the outcome of the process of cabinet formation. While there is robust empirical support for the theoretical proposition yielded by the model of war of attrition, the evidence in favour of the theoretical propositions from the two alternative models is only weak.

Fabrizio Carmignani
Dpeartment of Economics
Adam Smith Building
Glasgow University
Glasgow, G12 8RT
e-mail: 9322561c@student.gla.ac.uk
fabrizio.carmignani@unimib.it

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Introduction

The issue of political bias in economic policy formation has been traditionally treated in the economic literature within the framework of two-party models. The resulting picture is one where one party alone (the winner of the electoral contest) is in control of the absolute majority of the seats in the legislature and therefore a single-party majority government can be formed. This implies a relatively low degree of dispersion of political power within the policy decision making process.[2] Real world examples of *single-party majority systems* are the UK, Canada, Japan and possibly USA.[3] However, most of modern (parliamentary) democracies are better characterised as *coalition systems*; that is, countries where the executive is supported by a coalition of not fully homogeneous parties and the legislature is composed by a relatively large number of polarised political formations[4].

In coalition systems, policy formation is most likely to be achieved through a (potentially lengthy) process of bargaining whose complexities cannot be accounted for by bi-partisan models. It is therefore necessary to develop an appropriate theory of political bargaining in multi-party systems. This issue has been the object of a vast research in political science and a survey of the contributions in this field is beyond the scope of this paper.[5] However, the common denominator to most of the work in this area has been the focus on spatial models of legislative voting, with little or no attention at all to the role of the executive (i.e. the cabinet). The implicit assumption of this approach is that countries are governed directly by their own parliaments and that the policy-agreement which represents the equilibrium of the voting game is implemented automatically. In fact, this assumption is at odds with the institutional design in most modern democracies where it is the cabinet to be responsible for the actual implementation of real policy decisions whilst the legislature retains the power of making and breaking the government. Therefore, the cabinet plays a key direct role in policy formation while the parliament has a more indirect (albeit still important) role. It follows that a good understanding of policy formation requires a good understanding of cabinet formation, defined as the identification of a specific structure of portfolios-allocation among a given set of coalition partners.

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[2] Alesina, Roubini and Cohen (1997) and Persson and Tabellini (1998) survey a number of theoretical models with these specific features.

[3] The USA are a truly presidential democracy where forms of *divided governments* tend to occur rather frequently (Alesina and Rosenthal, 1995). In a divided government, one party is in control of the Administration whilst the other party is in control of the Congress. Clearly this situation is different from the standard single-party majority government which can be associated to the UK.

[4] Of the group of the OECD countries, only UK, Japan and Canada have a single-party majority government in office at October 1999. In USA the government is divided (see footnote 3). Historically, also New Zealand can be characterised as a single-party majority system, even if it is currently governed by a minority coalition. Political scientists associate countries with single-party minority governments (such as the Scandinavian countries) to coalition systems. Similarly, semi-presidential democracies such as Finland and France are classified as coalition systems (see Laver and Shepsle, 1994). Therefore, it can be argued that the large majority of OECD countries are coalition systems. Newly formed eastern European democracies also exhibits a clear trend towards coalition systems.

This paper tackles the issue of bargaining over cabinet formation within the framework of the so-called *portfolio-allocation approach*[6] . The value added of my contribution is twofold. First, models of bargaining over portfolios allocation often have difficulties in explaining the existence of significant delays in cabinet formation. I therefore propose a theoretical model of bargaining based on a *war of attrition* where the strategic behaviour of coalition partners is intimately linked to formation delays. The technical set-up of the game is quite different from other applications of the war of attrition.[7] In existing applications, the valuation of the prize of the game for generic player *i* is unknown to the other players, but known with certainty by *i*. In the model I propose, under some circumstances, the value of the prize for *i* is not even known with certainty by party *i* itself. This is equivalent to say, using a standard war of attrition terminology, that a player does not know with certainty his true nature (or type). Clearly, such a strong form of uncertainty must be incorporated into the procedure to determine the equilibrium of the game.

Second, I explicitly compare the war of attrition to two alternative models which can be adapted from the theory of bargaining in markets to the problem of political bargaining. This comparison is based on an empirical test of the main theoretical propositions yielded by each of the three models. This test also offers the opportunity for a systematic investigation of the empirical evidence concerning some of the key features of the process (and the outcome) of political bargaining over cabinet formation.

The rest of the paper is organised as follows. Section 1 briefly discusses the assumptions concerning the social context of government formation as stated in the portfolio-allocation approach. Section 2 presents the model of war of attrition. Section 3 contains an intuitive discussion of the main features of the two alternative models.[8] Section 4 discusses the empirical results. Section 5 concludes and sets the lines for future research.

Section 1. Assumptions and some stylised facts.

The construction of a model of cabinet formation requires some assumptions to be stated concerning: (i) the type of incentive parties involved in bargaining can have, (ii) the specific form of the decision

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[5] The interested readers can refer to Laver and Schofield (1990) and Laver and Shepsle (1996) and the references therein cited.

[6] The *portfolio-allocation approach* has been proposed in two seminal papers by Austin-Smith and Banks (1990) and Laver and Shepsle (1990) as a way to overcome the ambiguity concerning the role of the executive in the traditional approach to government formation. Laver and Shepsle (1994 and 1996) have successively further developed the new approach

[7] The original war of attrition has been proposed in theoretical biology to analyse the conditions for the stable evolution of species (see Maynard Smith, 1982, *inter alia*). The most popular application of this game to economic problems is probably due to Alesina and Drazen (1991). Bulow and Klemperer (1997) provide a strictly game-theoretic characterisation of the generalised model of war of attrition.

[8] Since these models are adaptations of rather well-known models of bargaining in markets and bargaining over the *allocation of a cake* I prefer focusing on the intuition behind their theoretical predictions. A more complete technical treatment of these two alternative models can be found in Carmignani (1999b) and it is available from the author upon request.

making process within the executive, (iii) the relationship between a party and its members sitting in the cabinet, (iv) party's valuation of different portfolios. The model of war of attrition I develop in the next Section moves from the same set of assumptions that underlie the original formulation of the portfolio-allocation approach. These assumptions are derived from a series of stylised facts that have been observed by country experts who have investigated the social context of government formation and decision-making in coalition systems. [9] A brief statement of these assumptions (and associated stylised facts) is given in this Section.

To start with the issue of party's incentive, it has to be stressed that all parties tend to display some public policy position and do have an interest in having as much as possible of this policy effectively implemented by the cabinet. In other words, all parties are interested in policy outputs and they want these outputs to be as close as possible to their own ideal policy or public policy position. This can be due either to a true concern for policy issues (if the party is policy-motivated) or simply to the need to enforce long-term credibility with voters and potential partners in order to enhance chances to stay in power (if the party is opportunistic or office-motivated). However, the extent to which a party will be ready "to fight" to have its policy position implemented will depend on this party's effective degree of office-motivation relative to policy-motivation (that is, on party's true nature). In general, more office-motivated parties tend to be less "hard-nosed" in the sense that they are less willing to delay cabinet formation by keeping on bargaining for long periods. The true nature of each partner is not necessarily public information at the beginning of negotiations.[10]

Turning to the issue of decision making within the executive, experts stress that, in spite of the formal provision of collective responsibility for cabinet decisions, individual ministers enjoy a considerable degree of autonomy in setting policies in areas that fall under their jurisdiction. A Minister's discretion can take several forms. For example, he can decide whether or not (and eventually when) to bring an issue to the cabinet meeting. If the issue is politically "hot", and hence it must be taken to the cabinet quickly, then discretion results in the ability of the minister to prepare a detailed policy proposal which is seldomly opposed (or even debated) by other ministers.[11] Overall, the decision making process can be assumed to have a strong departmental character.

The issue of the relationship between the party and its members who sit in the parliament is essentially one of understanding whether or not ministers can be taken to act as representatives of their own party. Indeed, senior members of the same party should share the same ideological orientation, or at least be ready to defend the same public policy position. This of course does not mean that all party members

[9] Country expert reports can be found in Laver and Shepsle (1994) and in Browne and Drejimanis (1994)

[10] Unobservable factors such as the intrinsic motivation of party's leaders and the extent to which they think it is important to defend the interests of their supporting constituencies are likely to determine the effective degree of office-motivation relative to policy-motivation.

[11] As Laver and Shepsle (1994) put it "Given the intense pressure of work and the lack of access to civil service specialists in other departments, it seems unlikely that many cabinet ministers will be able successfully to pock their noses very deeply into the jurisdictions of their cabinet colleagues " (Laver and Shepsle, 1994, pag. 296).

must always agree on all issues. Internal disagreement is probably an essential feature of modern democratic political formations. However, when interacting with the outside world (electorate, coalition partners, opposition) political parties do have an incentive to appear as *unitary actors*. By this it is meant that individual politicians will behave in a disciplined manner, defending and promoting the policy position defined in party's manifestos or enhanced by party's decision making bodies. The observation that usually parties enter and leave coalitions as unitary blocs and that various forms of punishment are at work for those members who openly defy party's positions should suggest that, in the end, parties are unitary actorrs. Henceforth, members who sit in the cabinet will act as "representatives" of party's policy interests.

Finally, there is wide agreement over the fact that some dimensions of the policy space are more important than others since they relate to areas of particular interest to voters (among these, the economic dimension seems to occupy a dominant position). This in turn implies that politicians will tend to value more those portfolios whose jurisdiction extends over the more important dimensions. It then follows that a *ranking of portfolios* can be constructed for any country, top-ranked portfolios being those for which any party's incentive to bargain are larger. The algorithm proposed by Laver and Hunt (1992) for the aggregation of several rankings compiled by different country experts in 12 western European coalition systems yields the interesting result that the portfolio of *finance* is by and large the most important one in all the countries surveyed. The second most important portfolio is the one of *foreign affairs* in 10 countries out of 12. Moreover, only for a few countries it is possible to distinguish between a third most important portfolios and the group of the *other portfolios*. In no case a fourth most important portfolio emerges.[12] Therefore, it can be argued that in most coalition systems there is a small set of *key portfolios* (the top-ranked ones) and that control of these portfolios is what coalition partners are most willing to obtain.

To summarise, from the observation of some stylised facts the following picture concerning the context of cabinet formation and of decision making is obtained. Policy outputs are heavily affected by the structure of portfolios allocation among coalition partners. In particular, given the strong departmental character of the decision making process, the economic policy undertaken by the cabinet will reflect to a considerable extent the policy preferences of the minister in control of the key portfolio of finance. Since, ministers tend to act as representatives of the party their members of, the necessary condition for a party to have its most preferred economic policy implemented is to have one of its members in control of the portfolio of finance. The portfolio of finance (and eventually the small set of other key portfolios whose jurisdiction extends over the most important dimensions of the policy space) is therefore to be

[12] A Table with a clear summary of portfolios ranking in the 12 coalition systems surveyed by Laver and Hunt (1992) can be found in Laver and Shepsle (1996, pag. 153).

regarded as the real object of bargaining in cabinet formation. Next Section will try to formalise the strategic behaviour of parties involved in this *fight* over the control of the key portfolio(s).

Section 2. Cabinet formation as a war of attrition.

The war of attrition is a timing game that for the case of cabinet formation can be simply characterised as follows. At the beginning of negotiations, each coalition partner[13] will demand to obtain control of the key portfolio of finance (the object of bargaining). Then bargaining will proceed, with any partner refusing to give up its demand in the hope that the other parties will give up first. Since bargaining is costly and the value assigned to being in control of the portfolio of finance is finite, for each partner there exists an *optimal time of concession*; that is, a point in time such that keep on bargaining beyond that time is no longer the optimal strategic choice. Thus, once this point in time is reached, the party will exit negotiations, leaving the survivors to compete for the object of bargaining. Eventually, just one survivor will be left. This party will be the winner of the war and it will receive control of the key portfolio. The very same logic can be extended to the fight over the control of the other key portfolios.

The qualitative features of the model can be introduced with the following simplified set-up. Let t represent the time at which the cabinet is effectively formed. t coincides with the end of the war of attrition; that is, t is the point in time at which one of the last two survivors decides to exit. For any $t > t$, the instantaneous utility payment received by the generic party i can be assumed to be equal to 0 if i is the winner (i.e. if i holds out for the longest time) and equal to $-\delta_i$ if i is one of the losers. The parameter δ_i is meant to reflect party i's true degree of policy-motivation relative to office-motivation. Therefore, not being in control of the portfolio of finance generates a larger utility loss the more policy-motivated the party is. Clearly, different parties are characterised by different degrees of policy-motivation relative to office-motivation and hence δ_i is *party-specific*. Moreover, it can be argued that a party's degree of policy and office motivation will depend on the nature of its leaders and on the extent to which these leaders think it is important to defend the policy interests of party's supporting constituencies. This implies that δ_i is likely to be *private information* of party i. In other words, only party i knows δ_i with certainty. Let ρ be the common discount factor. This will reflect expectations about the duration of the forming cabinet. The difference between being the winner and being one of the losers can be therefore written as:

$$(2.1) \qquad u_i = d_i / r$$

[13] Throughout the paper the assumption that the coalition set is already identified when negotiations over portfolios allocation start is retained. Following Strom (1990) and Merlo (1997) this assumption is perfectly realistic. However, the assumption could be relaxed and the war of attrition approach used to study also the issue of coalition formation besides the one of cabinet formation.

I refer to υ_i as to the *valuation of the prize of the game for party i.* Since δ_i is party-specific and private information of party *i*, whilst ρ is common knowledge and equal for all parties, the valuation of the prize will also be party-specific and private information of *i*. However, the usual assumption in the literature is to mitigate the hypothesis of incomplete information by letting the distribution $F(\upsilon)$ from which party-specific υ's are drawn be common knowledge.

If κ is the common instantaneous cost of bargaining[14], then, in the simplest case of a two-party coalition, a player whose prize valuation is υ will keep on bargaining for a time $T(\upsilon)$ implicitly defined by the equilibrium condition[15]:

$$(2.2) \qquad u\left[\frac{f(u)}{1-F(u)}\frac{1}{T'(u)}\right]=k$$

where $f(\upsilon)$ is the density associated to $F(\upsilon)$ and $T'(\upsilon)$ is the derivative w.r.t. υ of the behavioural function $T(\upsilon)$. This behavioural function univocally defines the time a party whose prize valuation is υ should optimally spend on bargaining. Clearly, this is equivalent to determining a point in time $t(\upsilon)$ at which it is optimal to concede: $T(\upsilon)$ is simply the length of the spell between the start of negotiations ($t = 0$) and the optimal time of concession $t(\upsilon)$. In other words, $T(\upsilon)$ is the *optimal bargaining spell* whilst $\tau(\upsilon)$ is the *optimal time of concession*. The optimal time of concession coincides with the end of the optimal bargaining spell.

Equation (2.2) has a clear intuitive interpretation. The l.h.s. is the expected benefit from waiting another instant to concede. This is equal to the prize valuation υ times the *hazard rate* (in brackets). The hazard rate is the probability that the opponent, who has not yet conceded, will exit the game at the next instant. Thus, the hazard rate represents the conditional probability of being the winner. The r.h.s. is the marginal cost of waiting for an additional instant. Therefore, what equation (2.2) states is that in equilibrium, the optimal concession time for a party whose prize valuation is υ_i is that point in time t_i, identified as the completion of a spell of length $T_i \equiv T(\upsilon_i)$, such that the marginal cost and the expected benefit from bargaining for an additional instant are equalised. Delaying exit beyond that time would constitute a non-optimal decision since it would reduce party's expected utility.

The explicit form of the behavioural function $T(\upsilon)$ is immediately obtained from (2.2). Assuming that υ_{min} and υ_{max} are the two known supports of the *F* distribution, the strategic behaviour of the generic party in the two-party coalition is fully described by the following:

[14] I consider κ to be equal across parties. Bulow and Klemperer (1997) show how the model can be immediately reinterpreted to allow for some heterogeneity of parties on the cost side.

[15] A formal proof of this equilibrium condition can be found in Alesina and Drazen (1991) and Carmignani (1999b)

(2.3) $T(u) = k^{-1} \int_{u_{\min}}^{u} x \frac{f(x)}{1-F(x)} dx$ with the boundary condition $T(u_{\min}) = 0$

Notice that, if coalition partners all had the same valuation of the prize, then they all would exit the game at the same time and the war of attrition would have no winner. Moreover, the optimal bargaining spell *T* is strictly increasing in the prize valuation υ. This implies that the winner of the war is the party that assigns the largest value to being in control of the portfolio of finance. If individual valuations were not private information, then the conflict over the allocation of the portfolio could be settled with no delay, since the identity of the winner would be immediately revealed. However, the hypothesis of incomplete information guarantees that the war must be played (and formation must be delayed) for information about individual prize valuations to be released and for the winner to be identified. The fact that the bargaining spell *T* is increasing in υ also explains the meaning of the boundary condition in (2.3). Since the supports of the distribution F(υ) are assumed to be common knowledge, a party with υ = υ_{min} will immediately realise it cannot win and hence it has no incentive to fight; that is, it will exit at time 0.

The above simple set up can be extended to consider the case of more than two coalition partners and different types of bargaining costs. So, let K+1 be the number of coalition partners. Also assume that the proportion γ of the total cost of bargaining κ is represented by political costs due to being associated to the ongoing (so far) unsuccessful formation attempt whilst the remaining proportion (1-γ) is represented by direct costs of bargaining (i.e. the costs of the resources spent for lobbying activities and the opportunity cost of time party leaders have to dedicate to coalition meetings). With K+1 players, K exits are required for the game to be completed. Any party dropping out before the K^{th} exit will stop paying the direct costs of bargaining, but it will continue bearing the political costs of being associated to an ongoing formation attempt. Only when the K^{th} exit is observed, and hence the winner is identified, the cabinet is officially formed and all parties do not bear any further political cost.

A model that incorporates those two extension is considered by Bulow and Klemperer (1997). However, as stressed in the Introduction, I propose a further extension to the original set-up. This extension determines a form of uncertainty about the prize valuation which is not treated in Bulow and Klemperer or in any other existing application of the war of attrition approach, to the best of my knowledge. The extension simply involves defining the instantaneous utility of generic party *i* for any $t > t$ as:

(2.4) $u_{i,t} = -d_i \left[q^* - q_i \right]^2$

where θ_i is the position of party *i* on a left-right policy scale and θ^* is the policy effectively undertaken by the cabinet.

Because of the strong departmental character of the decision making process, θ^* will be equal to the policy position of the winner of the war of attrition. This implies that if winner, party *i* will again receive an instantaneous payment equal to 0. If loser, party *i* will suffer from a disutility proportional to the Euclidean distance between the policy position of the winner and its own policy position. Equation (2.4) also states that for any given Euclidean (or ideological) gap, the disutility will be larger, the more policy-motivated party *i* is. From (2.4), the difference between win and defeat in the war of attrition is now equal to:

$$(2.5) \qquad u_i = \frac{d_i \left[q^* - q_i\right]^2}{r} \qquad \text{with } q^* \neq q_i$$

Equation (2.5) incorporates the new complication that constitutes the theoretical innovation of my contribution: the prize valuation υ_i might be not known with certainty by party *i* itself. In fact, υ_i will not be known with certainty by party *i* before the end of the game unless the game is a two-party negotiation or unless *i* is one of the last two survivors in a negotiation with more than two parties. To see this, consider that to know υ_i with certainty party *i* must know with certainty both its own degree of policy-motivation δ_i and the size of the Euclidean gap $(\theta^*-\theta_i)$ when $\theta^* \neq \theta_i$. By assumption δ_i is always known with certainty by party *i*. It can also be assumed that the policy positions of all the partners in the coalition are common knowledge. However, this is not enough to guarantee that the Euclidean gap is known with certainty by the party. If the game is at the final stage, and only party *i* and party *j* are still competing, then it is clear that the Euclidean gap must be $(\theta_j - \theta_i)$, with $\theta^* = \theta_j \neq \theta_i$. The situation is absolutely equivalent to the one faced by party *i* in the simplified two-party set-up previously discussed; that is, party *i* exactly knows the size of the disutility cost associated to being the loser. But suppose that the game is not at the last stage and that there are three survivors left: *i*, *j* and *z*. Then, if *i* decides to quit, the winner might be either *j* or *z*, but this will be revealed only after some time in the future. So, when comparing the marginal cost of bargaining and the expected benefit from extending bargaining for an additional unit of time, party *i* cannot be sure whether its instantaneous disutility cost associated to being the loser will be $-\delta_i(\theta_j - \theta_i)^2$ or $-\delta_i(\theta_z - \theta_i)^2$. That is, party *i* will be unsure about the difference between win and defeat (i.e. about the valuation of the prize of the game) in spite of the fact that the policy positions of all the partners are common knowledge. In general terms, this uncertainty will always exist at any stage of a game with more than two parties. Eventually, player *i* could become certain about υ_i at the last stage of the game if he is one of the last two survivors. But even in this case, uncertainty would persist at any stage before the last-one.

In this new setting, the assumptions that δ_i is private information and that the distribution of prize valuations $F(\upsilon)$, with supports υ_{min} and υ_{max} , is common knowledge can still be retained as long as it is assumed that the policy position of all coalition partners is common knowledge, fixed throughout the duration of the game and chosen independently from the degree of policy-motivation δ_i.

To solve this game, expectations over (2.5) must be taken as follows:

$$(2.6) \qquad u_i = \frac{d_i}{r}\left[E_t\left(q^* - q_i\right)^2\right] \qquad \text{with } \theta^* \neq \theta_i$$

where *E* is the expectation operator.

The expectation in (2.6) is essentially an expectation formulated at any $t < \tau$ about the identity of the winner, given the *risk-set* (i.e. the set of survivors) at time *t*. An explicit algebric formulation of the expectation in (2.6) can be incorporated in the definition of the prize valuation as follows[16]:

$$(2.7) \qquad u_i = \frac{d_i}{r}\left[\sum_{i \neq j}\left(q_j - q_i\right)^2 f\left(u_j\right)\left[F\left(u_j\right)\right]^{m-1}\right]$$

where *m* is the dimensionality of the risk-set (that is, *m* = K+1 in the initial stage, *m* = K after that the first party has dropped, *m* = K-1 after that the second party has dropped out, and so forth).

Notice from equation (2.7) that the prize valuation υ_i is increasing in the degree of dispersion of the policy positions of the coalition partners. Another way to express this same concept is to say that the more ideologically heterogeneous the coalition is, the more important is for any coalition partner to obtain control of the key portfolio of finance. The intuition behind this result is straight-forward. A larger degree of ideological heterogeneity increases the probability that party *i* will be taking part in a cabinet that undertakes an economic policy significantly different from party *i*'s public policy position. If instead, the coalition is homogenous in terms of policy preferences of its partners, then the probability that the policy output will be closer to party *i*'s policy position even if party is one of the losers will increase. In the first case, getting control of the key portfolio of finance is therefore more important for any give degree of policy-motivation relative to office-motivation.

The game will proceed in stages. A new stage starts immediately after that a party has quit the game. The initial stage will involve all the K+1 coalition partners. Then, one of them will eventually decide to quit. At this point the risk set reduces to a *m* = K dimensionality: a new prize valuation υ_i is computed

[16] Since the optimal bargaining spell is strictly increasing in υ, to form an expectation about the size of the Euclidean gap in case of defeat, player *i* must take the weighted average of all the Euclidean gaps between its own policy position and the policy position of any other coalition partner *j*, with weights represented by the probability that any given *j* is the winner. This weighted average is the term in brackets on the r.h.s. of (2.7).

by all survivors using (2.7) and the game enters the second stage. In general, an exit implies the beginning of a new stage and price valuations are re-computed each time. It is thus covenient to label υ_i with a subscript n = 0…..N, denoting the specific stage of the game. Clearly 0 will represent the initial stage, when none of the parties has already exited the game and N will represent the last stage, when only two survivors are left. Notice that at stage n, the risk set will still include $m = K + 1 - n$ survivors. The proposition in Bulow and Klemperer (1997) can then be used to show that, at generic stage n, a party i with prize valuation u_i^n will exit negotitations, if none of the other $m = K + 1 - n$ survivors exits first, $T(u_i^n)$ units of time after the beginning of that specific stage n, where $T(u_i^n)$ is defined by:

$$(2.8) \qquad T(u_i^n) = g^{m-2} \int_{u_{\min}}^{u_i^n} x \frac{f(x)}{1-F(x)} dx$$

In equation (2.8) κ has been normalised to one. Notice also that, at each stage, the first party to quit is the one with lowest prize valuations. This result is clearly consistent with the one obtained in the semplified two-party setting.

The total duration of the war of attrition wil be given by the sum of N terms like (2.8):

$$(2.9) \qquad T = \sum_{n=0}^{N} \left[g^{m-2} \int_{u_{\min}}^{u_i^n} x \frac{f(x)}{1-F(x)} dx \right]$$

where the upper limit of integration is defined by (2.7) with $m=K+1-n$.

The clear-cut implication of equation (2.9) is that the duration of the war of attrition, for a given known υ_{min}, γ and K, will be increasing in the prize valuations. As noted above, from eqaution (2.7) it can be seen that prize valuations are increasing in the degree of dispersion of the policy positions of the coalition partners. Therefore the rather intuitive prediction obtained from the model of war of attrition is that *the time required for the cabinet to be formed is increasing in the degree of ideological heterogeneity of the coalition (*defined as the degree of dispersion of the policy locations of coalition partners).

Another interesting result relates to the impact of the parameter γ. Notice from (2.7) that the larger γ, the longer the duration of the war of attrition. γ is the proportion of the total bargaining cost due to political costs. The nature of this political costs is such that they are borne by parties even after they have decided to quit the game and until the game itself is not settled. Whilst a larger total bargaining cost κ would reduce the length of the war of attrition (if not normalized to 1, κ in equation (2.9) would be rised to a negative power), for any given κ, the larger the share of political costs, the longer the time

parties are willing to wait before conceding. This is because a larger share of political costs reduces the "saving" associated to quitting negotiations before an agreement has actually benn reached.

The model can be further generalised to the case of bargaining over more than one key portfolio. One of the following two assumptions can be made. First, the winner of the war of attrition gets control of all the key portfolios which are the object of bargaining. Second, the set of key portfolios is shared by a small set of winners. In the first case, the model generates a *corner solution* to the problem of cabinet formation. In the second, more realistic, case the actual policy output is likely to be a *compromise* between the preferred policy positions of the winners. However, as discussed in Carmignani (1999a), whichever of the two assumptions is made, the key result that bargaining will last longer the more dispersed are the policy positions of coalition partners holds true.

Section 3. Two alternative forms of political bargaining.

In the Political Science literature lots of theoretical models of bargaining have been proposed to analyse the process of government formation in multi-party systems. These works can be classified in two broad categories. The first one includes models that build over the problem of how to allocate a cake of a given size among a set of players, where each player has an interest in getting the largest possible slice.[17] These models interpret the set of cabinet posts as the cake and each coalition partner negotiates in order to obtain the control of as many cabinet posts as possible. The models in the second group can be characterised as *spatial models of voting*. In these models parties bargain directly over policy outcomes to achieve an agreement represented by a specific policy proposal whose details are described in a *coalition treaty*. Such a treaty will then strictly constrain the autonomy of cabinet members. I thus consider two forms of political bargaining in alternative to the war of attrition approach of the previous Section: one is set in the spirit of the models of bargaining over the allocation of a cake and the other is set in the spirit of the models of bargaining directly over policy outputs. A full technical description of the two alternative models is given in Carmignani (1999a). Here I focus on the intuition behind the main theoretical predictions obtained from each of the two.

There are several possible ways to formalise the process of bargaining over the allocation of a cake of fixed size. The one considered by Rubinstein (1985a,b) is probably the most appropriate to represent real world coalition politics. This is a game of alternating offers[18], where the first mover is identified

[17] The original formulation of the problem of bargaining over the allocation of the cake goes back to Rubinstein (1982).

[18] An offer is a proposal about the allocation of the cake made by one party. In the game with alternating offers, the formateur party makes the first move. If its proposal is rejected, then one of the coalition partners will make a new offer. The process will continue until one of the parties makes an offer which is accepted by all the others.

with the *formateur* party and where there exists an asymmetry in the distribution of information. In particular, the formateur party is taken to be the uninformed party (relative to the other coalition partners). The reason for the existence of this asymmetry has to do with the peculiar status of the formateur in the formation process. If the formation process is successful, then the formateur will often receive the office of prime minister. But if the formation attempt fails, then the formateur will be held responsible for this failure and blamed more than the other coalition partners. So, overall, it is well known to everybody how important is for the formateur to make the formation attempt successful. The same it is not quite true for other coalition partners. Of course, they are likely to prefer a success to a failure, but exactly how much they prefer the former to the letter is not known with certainty by the formateur.

This model with alternating offers and asymmetric information yileds the prediction that the share of cabinet posts received in equilibrium by the formateur party is smaller the longer the duration of the negotiation process. The intuition behind this result is simple. A long negotiations is an indicator of a rather complex bargaining environment. When the bargaining environment is complex, the chances to achieve an agreement are low and the probability that the formation attempt will fail is high. Faced with this high probability of failure, the formateur party is willing to give up some portfolios in order to facilitate the agreement with the partners. Therefore its share will be decreasing in the length of negotiations.

The second alternative approach to government formation is based on the assumption that parties directly bargain over policy outcomes, so that the cabinet is effectively formed when a specific position in the policy space is agreed upon by all coalition partners. A useful way to represent this interaction is to let parties bargain over policy outcomes more or less in the same way as sellers and buyers bargain over the price of an indivisible good to be traded. With such an interpretation of the negotiation process, the results achieved in the literature on bargaining in markets can be used. In Carmignani (1999a) I make use of a set-up adapted from Cramton (1992). The resulting model yields an interesting prediction about the relationship between duration of the formation process and *degree of balance* of the outcome of the process itself: long negotiations are associated to more balanced outcomes. The intuition behind this proposition can be grasped quite easily by considering the case of a two-party coalition. Negotiations last for a long time if the two parties are *hard-nosed*. These hard-nosed parties make only little concessions at each stage of the game. Since they are both of the same nature, the rate at which they make concessions can be taken to be almost identical and hence they will eventually achieve a policy agreement which is somehow intermediate between their own initial policy positions (i.e. their ideal policies). The low rate at which concessions are made implies that such agreement is reached only after a lengthy negotiation. If instead one of the two parties is *weak*, then it will make faster concessions. This will result in a faster agreement, characterised by a policy proposal closer to

the ideal policy of the hard-nosed party. So, relatively short negotiations can be associated to more unbalanced outcomes. However, it can also be the case that both parties are weak. In this situation, they both make concessions at the same high rate. The consequence is that the policy agreement will be reached very quickly and it will be again intermediate between the two original policy positions. Henceforth, according to the theory, there could be a possible non-linearity in the relationship between the degree of balance of the bargaining outcome and the duration of the formation process. In the Cartesian space with duration on the horizontal axis and degree of balance on the vertical axis this non-linearity would be U shaped.

Section 4. Econometric analysis of the cabinet formation process

This econometric Section is divided into four Subsections. The first-one describes the data and the sample used for the analysis. The next three subsections deal with the test of the three theoretical propositions discussed in the previous two Sections.

4.1 Sample and data set.

The sample includes thirteen western European coalition systems[19] observed throughout the period 1950-1995. The political data are those of the data-set described in Carmignani (1999b). A definition of the variables is given in the boxes below. The Appendix will discuss in some length the measures of the degree of balance of the outcome of the formation process.

BOX 1. Political Variables

Fragmentation of the legislature (FRA): effective number of parties in the legislature as a whole. The effective number of parties is computed as the inverse of the sum of squared share of seats held by all parties with parliamentary representation (Laasko and Taagepera, 1979).
Polarisation of the system (POL): share of support expressed by voters for "extremist parties" (Powell, 1982).
Absolute Number of Parties in the coalition (ANP): total number of parties in the ruling coalition; each party is counted as one, independently from its parliamentary size.
Effective Number of Parties in the coalition (ENP): computed as FRA, with the difference that ENP includes only coalition partners and that the share of seats for each coalition partner refers to the proportion of seats controlled by the coalition partner over the total number of seats controlled by the coalition rather than over the total number of seats available in the parliament.
Real Number of Parties in the coalition (RNP): ANP divided by the total number of key portfolios in a cabinet. Key portfolios are identified following Laver and Hunt (1992).
Alternation (ALT): share of seats held by parties leaving the executive plus the share of seats held by parties entering the executive (Strom, 1984).
Conflict of Interest (CI): dispersion of the policy positions of coalition partners. It is a measure of the degree of ideological heterogeneity of the coalition. The formal definition is as follows: $CI = \sum_{i=1}^{n} p_i \left| q_i - W \right|$, where p_i is the proportion of coalition seats held by generic coalition partner *i*, *n* is the total number of coalition partners and θ_i is the location of party on a left-right policy scale. *W* is the weighted average location of the coalition: $W = \sum_{i=1}^{n} \{ p_i q_i \}$.

Total Portfolio Volatility (TPV): sum of (i) the number of portfolio whose holder changes when the incumbent cabinet is replaced by a new-one, (ii) the number of new portfolios created in the incoming cabinet, (iii) the number of portfolios eliminated (Huber, 1998).

[19] Austria, Belgium, Denmark, Finland, France, Germany, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norway and Sweden.

BOX2 Political variables (continue)

Ideological Portfolio Volatility (IPV): sum of the Euclidean distances for each portfolio change divided by the total number of portfolios transferred (Huber, 1998). Euclidean distances are computed using a left-right policy scale reporting the cardinal locations of individual coalition partners. Details on the construction of this policy scale can be found in Carmignani (1999,b).

Post-election formation (POST): dummy variable taking value 1 if the cabinet is formed immediately after a general election (whether anticipated or not).

Caretaker status (CARE): dummy variable coded 1 if the cabinet is explicitly of a caretaker nature; the classification

Continuation of the coalition (COALC): dummy variable taking value 1 if the incoming cabinet is supported by the very same coalition of parties that supported the outgoing cabinet.

Reason for Termination (RFT): dummy variable coded 1 if the outgoing cabinet terminated because of *political reasons*, i.e. if the cabinet terminated for any reason other than mandatory (non-anticipated) elections or illness of the prime-minister.

Duration of the formation process (LNDUR): log-duration (in days) of the cabinet formation process. Cabinet formation starts at the time when a set of potential coalition partners is identified and ends at the time when the new cabinet has passed the final institutional hurdle that applies for the specific country (namely, a swearing-in ceremony or a formal investiture vote granted by the parliament).

Relative size of the formateur party (DCOAL): dummy variable coded 1 if the *formateur* is the largest party in the coalition

Strength of the formateur (DSTRONG): dummy variable coded 1 if the *formateur* party is the largest in the parliament and includes the median legislator (i.e. the legislator at the median of the distribution of the positions on the policy scale of all the legislators in the parliament).

Share of seats of the formateur (SHS): share of parliamentary seats held by the *formateur* party as proportion of total coalition seats.

Share of key portfolios secured by the formateur (SHP): share of key portfolios controlled by the *formateur* as a proportion of the total number of key portfolios in the cabinet.

Previous Defeat (DEF): dummy variable taking value 1 if the formateur party held the office of prime minister in the outgoing cabinet and this latter terminated because of *political reasons*.

Relative size of coalition partners (SIZE): ENP divided by ANP (see BOX 1).

Degree of Unbalance of the bargaining outcome: degree to which the outcome of the negotiation process can be defined as unbalanced. More technical details are given in the Appendix.

Investiture Vote (INV): dummy variable coded 1 for those countries where a formal investiture vote is needed for the cabinet to be effectively formed (Diermier and Van Roozendaal, 1998).

Continuation rule (CONT): dummy variable coded 1 for those countries where the incumbent cabinet may continue in office without having to resign even if elections are held or where partners in the incumbent coalition have the right to make the first proposal in the formation of the new coalition (Diermeier and Van Roozendaal, 1998).

The economic situation (or the perception that voters and politicians have about the economic situation) is likely to have some kind of impact on the duration and the outcome of the political bargaining process. To control for this potential impact, the econometric specification will include the average rate of change (contemporaneous and lagged) of three key economic indicators: the consumer price index, the exchange rate index and the industrial production index. The idea is that voters and politicians will form an opinion about how well the economy is doing by looking at the rate of inflation, at the strength of domestic currency *vis-à-vis* foreign currencies and at the state of the "real" economy [20].

It is worth stressing that the inclusion of these economic variables is simply aimed at checking the sensitivity of the results concerning the political variables and that no explicit test of a theoretical model

[20] The contemporaneous rate of change is computed as the average rat of change of the indicator over the period of negotiations. The lagged rate of change is computed as the average rate of change of the indicator in the *n* months before the start of negotiations. The time-series for the three indices are taken from the Statistical Compendium – OECD. Ideally, the rate of unemployment (and its change over time) more than the growth of industrial production is what voters and politicians might look at in forming an opinion about the state of the real economy. Unfortunately the series available from the OECD (or alternatively from the International Monetary Fund) on unemployment are not sufficiently long and/or not always comparable across time and space. For this reason I have to revert to industrial production, which is positively correlated to unemployment and whose series are more "complete".

linking the economic situation to the structure of political bargaining is being undertaken. The construction and the empirical test of such a model could be an interesting avenue of future research.

4.2 Determinants of the duration of the bargaining process.

The theoretical model based on the war of attrition approach described in Section 2 yields the prediction that the duration of the process of cabinet formation is longer the larger the degree of dispersion of the policy preferences (i.e. ideological locations) of coalition partners. Therefore, to test this prediction, an analysis of the determinants of the duration of the political bargaining process has to be undertaken. In spite of the vast theoretical literature in this area, there are only two empirical works which are related to my enterprise. Merlo (1997) constructs a theoretical model of bargaining where the set of coalition partners is fixed and the identity of the proposer changes according to a Markov stochastic process. The theoretical implications of this model are then tested using data from government formations in post-war Italy. Diermeier and Van Roozendaal (1998) apply *event-history analysis* to a panel of thirteen western European countries (the same countries included in my sample) observed throughout the period 1945-1990. Strictly speaking, the purpose of their analysis is to explore the empirical adequacy of alternative models of coalition (rather than cabinet) formation. However their results are directly comparable to mine.

In none of the two studies above mentioned the issue of how the degree of ideological heterogeneity of coalition partners affects the duration of the formation process is explicitly addressed. In particular, Diermeier and Van Roozendaal (1998) do include in their model specification a few political variables somehow related to the dispersion of policy preferences within the legislature, but these measures cannot be regarded as direct indicators of the degree of ideological heterogeneity of coalition partners. Moreover, the impact of economic variables is not controlled for.

In what follows I operationalize the duration of the formation process as the spell between the time at which a new set of potential coalition partners is identified and the time at which the new cabinet formally enters office. The set of coalition partners is usually identified at the date of appointment of the *formateur* party or, in some cases, already at the time of the formal resignation of the outgoing prime-minister (or at the time of the general elections, if general elections were the cause of termination of the outgoing cabinet). The new cabinet formally enters office after a swearing-in ceremony or, in a few countries, after that a formal vote of investiture has been granted by the parliament. Average durations for each country in the sample are reported in Table 1 below.

country	*average duration (days)*	*country*	*average duration (days)*
Austria	36.888	Iceland	29.764
Belgium	39.142	Ireland	18
Denmark	8.888	Italy	37.957
Finland	26.6	Luxembourg	27.142
France	11.761	Netherlands	71
Germany	26	Norway	11.666
		Sweden	11.863

Table 1. Average duration of bargaining over portfolios allocation in western European coalitions. Source Keesings Contemporary Archives.[21]

The analysis of duration data requires a specific statistical model to be developed.[22] To this purpose, let the process of cabinet formation be characterised as a stochastic process X_t taking values in the discrete space $\{E_0, E_1\}$. At time $t = 0$ (start of the negotiations), the process is in state E_0. Transition to state E_1 occurs only once, at time $t = T$, and it represents the end of negotiations. That is, at time T, the cabinet formally enters office. The time spent in state E_0 is therefore equal to the duration of the formation process and it is in the nature of a positive random variable. The conditional probability that transition from E_0 to E_1 will be observed between time *t* and time $t + dt$ is known as the hazard function $\lambda(t)$:

$$(4.1) \qquad l(t) = \lim_{\Delta \to 0} \frac{P[t < T < t + \Delta | T \geq t]}{\Delta}$$

The impact of political and economic explanatory variables on the length of the process can be estimated through the following *Proportional Hazards Model*, based upon the hazard function $\lambda(t)$:

$$(4.2) \qquad l(t; \mathbf{z}) = \exp(\mathbf{zb}) l_0(t)$$

where **z** is a set of explanatory variables, **b** is a set of coefficients to be estimated and $\lambda_0(t)$ is the *baseline hazard function*, that is, the hazard function of a cabinet such that $E(\mathbf{z}) = 0$.

Model (4.2) can be estimated following the flexible Partial Likelihood approach proposed by Cox (1972 and 1975). The coefficients in (4.2) can then be interpreted in a straight-forward manner:

[21] Daniel Diermeier made his data-set on formation duration available to me and I wish to thank him. However, I realised that the criteria he uses to identify the starting point of the process are in some cases different from the one I needed to use for my analysis. Therefore, I decided to construct my own time-series going back to the original source (the Keesings' record of World Events).

[22] A complete treatment of duration models can be found in Kalbfleisch and Prentice (1980). Kiefer (1988) discusses some economic applications of these models. A more detailed description of the model used in this

$$(4.3) \qquad \frac{\partial \ln l(t;\mathbf{z})}{\partial \mathbf{z}} = \mathbf{b}$$

According to (4.3) a one-unit change in a given explanatory variable has an estimated effect on the hazard function equal to the estimated coefficient raised to the exponential power. However, it must be kept in mind that since the hazard function is the probability of a formation attempt to be completed, a *positive coefficient* implies that *larger values* of the specific explanatory variable *reduce* the duration of the bargaining process.

Table 2 reports the results from the estimation of two models of duration. The degree of dispersion of policy preferences within the coalition (that is, the degree of ideological heterogeneity of coalition partners) is captured by the variable CI (*conflict of interest*). Thus, according to the prediction of the model of war of attrition, CI should display a negative and statistically significant coefficient. The results from the estimation of the politico-institutional model do support this theoretical prediction. The estimated coefficient is equal to -.2719 with a standard error of .152: the null hypothesis of a zero restriction on the coefficient can therefore be rejected at usual confidence levels.

Explanatory Variables	*Politico-institutional model*	*Combined model*
POST	-1.0833 (.136)	-1.111 (.164)
INV	-.0587 (.146)	-.293 (.168)
CONT	1.0034 (.173)	.958 (.211)
CARE	-.12008 (.251)	-.035 (.291)
COALC	-.01209 (.167)	.041 (.219)
RFT	-.1526 (.134)	-.179 (.170)
CI	-.2719 (.152)	-.309 (.186)
POL	-.6415 (.573)	-.663 (.703)
FRA	-1.3140 (.937)	-1.332 (1.09)
TPV	-.0232 (.011)	-.005 (.013)
IPV	.00298 (.083)	-.0407 (.097)
ALT	.05075 (.300)	-.130 (.371)
DSTRONG	-.1275 (.133)	-.109 (.153)
CPG		-.210 (.171)
ERG		-.597 (.275)
IPG		-.043 (.020)
CPG(3)		-.044 (.202)
ERG (3)		-.099 (.038)
IPG(3)		-.040 (.037)
Observations	319	228
Log-rank test	140.335 (p-value = .0000)	106.311 (p-value = .0000)
Log-likelihood	-1467.135	-968.035

Table 2. The determinants of the duration formation process. Standard errors are in brackets. The number in bracket next to the economic variables CPG, IPG and ERG is the number of lags. The log-rank test is a version of the Lagrange Multiplier Test of the null hypothesis H_0: $\mathbf{b} = 0$. High p-values imply rejection of the null and an overall good fit of the model.

Section is given in Carmignani (1999c). The specific estimation procedure I adopt was originally proposed by Cox (1972 and 1975).

Other politico-institutional variables do play an important role in determining the duration of the formation attempt. The negative and significant coefficient of the variable POST (*post-election formation*) implies that the formation process lasts longer if negotiations take place immediately after a general election. The intuition behind this result is that the bargaining environment is more complex immediately after an election than in any other case. This is because a general election is likely to have brought about important changes (such as new party leadership or a new distribution of seats and policy positions) which make it more difficult to achieve an agreement over the allocation of portfolios. The positive and significant coefficient attached to the dummy CONT (*continuation rule*) indicates that in countries where the continuation rule applies (Denmark, Norway and Sweden), durations are shorter. This finding is hardly surprisingly. The existence of a formal constitutional provision which states that the incumbent government does not necessarily have to resign when general elections are held and/or that it retains the right to make the first proposal in the new round of formation speeds up the whole formation process. Analogous results with respect to POST and CONT are obtained by Diermeier and Van Roozendaal. However, they also find the variable CARE (*caretaker status*) to have a significant (negative) coefficient, whilst in the estimates of Table 1 the coefficient I obtain is largely insignificant (the p-value is .633).

Two further findings from the politico-institutional model of Table 2 are worth a mention. The first one concerns the role played by the variable TPV (*total portfolio volatility*): the larger the number of changes in the structure of portfolios allocation the longer the process of negotiation. I believe that this finding is consistent with some common sense intuition. If the formation of the new cabinet requires many changes in the way in which portfolios are allocated, then the formation itself must stretch over a longer spell. The second one refers to the insignificance of the coefficients of the variables that reflect the ideological fragmentation of the party-system as a whole, FRA and POL. One could believe that larger degrees of polarisation and fractionalisation of the legislature should make bargaining significantly more difficult and this should result in longer negotiations. The negative sign of their estimated coefficients is consistent with this idea, but the large standard errors imply that the null hypothesis of a zero restriction cannot be rejected. Again, this latter finding is identical to the one in Diermeier and Van Roozendaal (1998).

The combined model in Table 2 includes economic variables in addition to political and institutional indicators. Notice that since economic time-series do not always go back to 1950 for all the countries, the sample for the estimation of the combined model is restricted to 228 observations. In spite of this loss of observations, the same results obtained from the estimation of the politico-institutional model with the full sample substantially hold true. The only relevant difference is represented by the coefficient on INV (*investiture vote*), which is now signficant. Its negative sign implies that in countries where a formal investiture vote is required for the cabinet to enter office formally, durations are longer. This

result is at odds with the one in Diermeier and Van Roozendaal (1998), where the same dummy INV displays a non-signficant coefficient.

Of the economic variables, only the rate of change of the exchange rate index (contemporaneous and lagged) and the contemporaneous rate of change of the industrial production index display significant coefficients. The combined model has been re-estimated with different lags and results do not change. A first temptative interpretation for the pattern of findings on these economic variables could be as follows. When economic conditions are perceived as negative, coalition partners might go under pressure to form the cabinet quickly. The negative coefficient of IPG and ERG (contemporaneous and lagged) would suggest that low rates of growth of the industrial production and appreciation of the currency (which reduce exports) are effectively indicators of a negative economic state. However, as already noted, the construction of a specific theoretical model to account for the link between the economic situation and the duration of the political bargaining process is the natural extension of the research in this area. Above all, what is really important here is that the inclusion of economic variables (and the associate restriction of the sample) do not alter the main finding concerning CI: a larger degree of ideological heterogeneity makes negotiations longer. Therefore, the theoretical prediction form the war of attrition model of Section 2 is supported by the empirical evidence.

The last bit of evidence concerning the duration of the formation process is given in Figure 1.

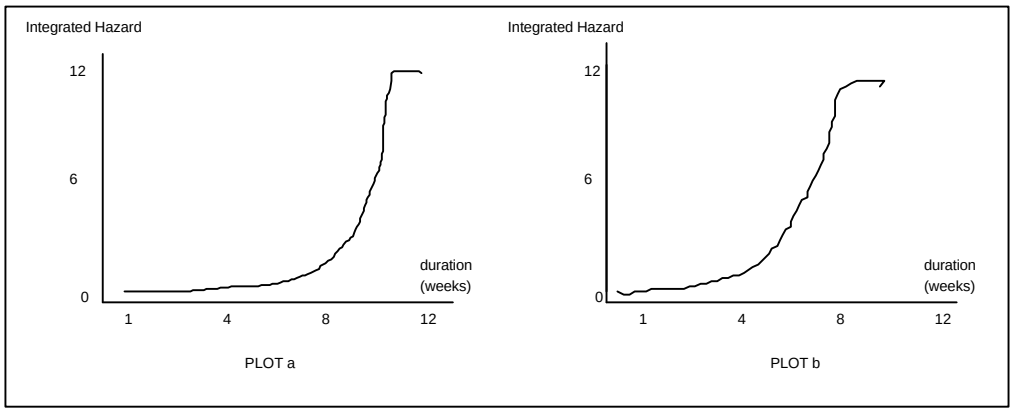

Figure 1. Plots of the integrated hazard function for the duration models of Table 2. Plot A refers to the politico-institutional model; plot B to the combined model.

This is a plot of the integrated hazard function $\Lambda(t)$ against duration. The integrated hazard is simply defined as:

$$\Lambda(t) = \int_0^t I(u)\,du \qquad (4.4)$$

and from its curvature in the Cartesian space it is possible to see whether the stochastic process used to represent cabinet formation displays positive or negative duration dependence. To be more specific, if

the integrated hazard is convex, then the process exhibits positive duration dependence; that is, the hazard function positively depends on time. If instead the integrated hazard is concave, then the process exhibits negative duration dependence; that is, the hazard negatively depends on duration.

It is clear that the integrated hazard is convex and hence that the process is characterised by positive duration dependence: the longer negotiations have already lasted, the higher the probability that they will be completed in the near future.

4.3 Determinants of the share of cabinet posts received by the formateur party

The first of the two alternative model of political bargaining builds on the bargaining game over the allocation of a cake (the set of cabinet posts) and yields the theoretical prediction that the share of cabinet posts (i.e. the slice of the cake) received by the *formateur* is smaller the longer the duration of negotiations. The empirical test of this proposition can be undertaken through an analysis of the determinants of the share of cabinet posts of the formateur.

An empirical test of a version of the model of bargaining over the allocation of a cake is proposed by Merlo (1997). However, in this test he does not focus on what determines the share received by the *formateur* (or by any of the other coalition partners), but instead he evaluates the performance of the theoretical model in fitting observed durations of negotiations. Other empirical works in this area basically focus on the test of the so called *Gamson's proposition*. According to Gamson (1961) the share of portfolios received by a coalition partners must be proportional on a one-to-one basis to that partner's share of coalition seats. Thus, when regressing the share of cabinet posts on a constant and on the share of coalition seats, one should obtain a value not different from zero for the constant term and an estimated coefficient not different from 1 for the share of coalition seats. For the case of the share of the formateur party, the results of the above regression (estimated on a sample of 181 cabinets[23]) yields the following results: the constant term is .050045 and the estimated coefficient of the share of coalition seats is .97359. However, a Wald test of the linear restrictions that the intercept is equal to 0 and the estimated coefficient is equal to 1 suggests that such restrictions can be rejected at usual confidence levels.[24] Therefore, even if the share of seats is a signficant determinant of the share of cabinet posts received by the formateur, other variables are likely to be important.

A peculiar problem associated with the empirical analysis of this Subsection is that the dependent variable, the share of cabinet posts received by the formateur, is in the nature of a *proportion*. That is, it is bounded between zero and one and therefore it violates the assumption of normality of the

[23] The sample consists of only coalition cabinets (thus single-party executives are excluded) for which a formateur party was explicitly appointed to conduct negotiations.

[24] The Wald test statistic for the two joint restrictions is 50.7584, with a p-value equal to .000.

distribution. It follows that simple OLS are not appropriate. The standard approach in the econometric literature is to treat proportion data within the framework of the *logistic regression* (see, *inter alia*, Greene 1993 and Amemyia, 1986). I therefore estimate the following model:

$$(4.5) \qquad s_i = F(\mathbf{b}'\mathbf{x_i}) + e_i \quad \text{with } E[e_i] = 0; Var[e_i] = \frac{F_i(1-F_i)}{n_i}$$

where $\mathbf{x}_i$ is a set of independent variables that might affect the share of cabinet posts of the formateur, s_i is the share of cabinet posts secured by the formateur in cabinet *i*, n_i is the total number of cabinet posts allocated to all coalition partners (including the formateur) and the functional form of the function F can be specified as follows:

$$F(\mathbf{b}'\mathbf{x_i}) = \frac{\exp(\mathbf{b}'\mathbf{x_i})}{1+\exp(\mathbf{b}'\mathbf{x_i})}$$

Notice that the regression model (4.5) implies heteroscedasticity and therefore some form of Feasible Generalised Least Squares might be the appropriate estimation method. Following Hosmer and Lemeshow (1989), a Weighted Least Squares (WLS) estimator based on a two-step procedure can be defined which is consistent and asymptotically normally distributed. Alternatively, Amemyia (1986) suggests using a Maximum Likelihood (ML) estimator which can be shown to have the same properties of the ML estimator. I will present the results from both the WLS and the ML estimators. In addition to that, just as a point of comparison, I will also report the results from the estimation of simple OLS (which are obtained from the first step of the procedure to derive the WLS estimator). Clearly, OLS estimates make the implicit assumption that the dependent variable is normally distributed and hence they are not efficient here.[25]

According to the theoretical prediction of the model of bargaining over the allocation of a cake, the duration of the bargaining process (LNDUR), should display a negative and significant coefficient, after controlling for other potential determinants of the share of cabinet posts of the formateur (SHP). Table 3 reports the results from the estimation of a politico-institutional model and of a combined model including the economic variables. Notice that the sample is reduced to 181 cabinets. As specified in footnote 24, these are the coalition cabinets for which a formateur party was explicitly identified at the beginning of the formation process.

[25] A potential problem with the logistic transformation of a variable is that if the variable takes value 0 or 1 then the transformation is not defined. The standard procedure in the literature is to add or subtract a small positive constant from the variable before applying the transformation. However, in the case of the share of

The variables SHS (*share of seats of the formateur*), DSTRONG (*strength of the formateur*) and DCOAL (*relative size of the formateur*) are all direct indicators of the *bargaining power* of the formateur. Therefore it can be easily argued that their estimated coefficients should all be positive. The other variables in the politico-institutional model, including (LNDUR) instead reflect the degree of complexity of the bargaining environment. Henceforth, according to the argument that with a more complex bargaining environment the formateur must give up some portfolios in order to facilitate the agreement, they should have negative coefficients, with the exception of CARE (*caretaker status*) and POL *(degree of polarisation of the system*). In effect, CARE and possibly POL are inverse rather than direct measures of the degree of complexity of the environment. The political importance of a caretaker government is often small. It has limited policy responsibility and it is frequently formed to fill in a time-gap before new elections are held. Therefore, in the negotiations leading to the formation of such a caretaker government, coalition partners are unlikely to be willing to spend much time and resources (they are probably already involved in the electoral campaign) and hence they will be ready to accept immediately the first proposal of the *formateur*. This proposal is clearly likely to be more favourable to the formateur itself. POL is defined as the share of support for extremist parties. Since, by definition, extremist parties are "non coalitionable", larger values of POL might indicate a smaller number of viable alternative coalitions and this in turn would make the bargaining environment less complex. Thus, in the end, the environment complexity argument would suggest that the coefficient of CARE and POL should be positive.

	Politico-institutional model			Combined model		
regressors	*WLS*	*ML*	*OLS*	*WLS*	*ML*	*OLS*
SHS	1.2978***	3.1258***	.41279***	1.2865***	3.1363***	.42989***
DSTRONG	.05478 *	.04877	.00706	.068907**	.07926	.0077231
DCOAL	.14424***	.62997***	.17654***	.19919***	.69247***	.18572***
DEF	.02286	.02403	.012514			
CARE	.19022***	.26508	.041239	.19526***	.26218*	.042061
CI	-.1985***	-.25271**	-.0645***	-.18714***	-.25990**	-.06771***
ENP	-.3796***	-.4880***	-.1603***	-.38838***	-.4521***	-.14461***
ANP	-.01716	-.06424	-.01493			
RNP	.29205***	.33215	.091804	.25513***	.26489**	.06201***
LNDUR	-.007256	-.27822	.0022327	-.014127	-.039985	-.00117
POL	.09333	-.00324	-.099778			
FRA	-.31869	.69716	.18617			
CPG				1.4331	-5.2062	-.21309
CPG(2)				6.0077**	13.724	1.795
ERG				1.4601**	3.533*	.52408*
ERG(2)				.31204	.99029	.1591

Table 3. Determinants of the share of cabinet posts received by the *formateur* party. There are 181 observations in the sample. The dependent variable is the share of cabinet posts received by the formateur (SHP). *** indicates significance at the 1% level, ** indicates significance at the 5% level and * indicates significance at the 10% level.

cabinet posts of the formateur it must be stressed that SHP is never equal to 0 or 1 (i.e. the formateur always receives at least one cabinet post and never receives all cabinet posts).

The duration of the formation process enters the specification in log form (LNDUR) and it display the expected negative coefficient. However, this is not significant even at the 10% level of confidence. Thus, there is only weak support to the theoretical proposition of the first alternative model discussed in Section 2.

All but two coefficients in Table 3 have the expected sign. The two exceptions are the coefficients associated to DEF (*previous defeat*) and RNP (*the real number of parties*). However, the coefficient of DEF is not statistically different from zero at usual confidence levels, so that the only really unexpected finding is the one concerning RNP. To account for this unexpected finding one should imagine the existence of a *compensation mechanism* working as follows. Large values of RNP reflect a more complex bargaining environment since they indicate that the number of coalition partners is large relative to the number of key portfolios. To facilitate agreement, the formateur would be ready to give up the control of the key portfolios, obtaining, as a compensation, a relatively large number of non-key portfolios. Thus its total share of portfolios could be actually increasing in RNP. Such a mechanism would imply that, especially when coalitions are large, the formateur does not receive control of key portfolios, an implication which has to be checked through additional empirical work in the future.

The estimates also suggest that the strongest determinant of SHP is SHS (*share of seats of the formateur*), but other political variables do play an important role. This is particularly true for three of the variables reflecting the degree of complexity of the bargaining environment (CI, ENP and CARE).

Economic variables are then added to the politico-institutional model and the resulting combined model is re-estimated after dropping insignificant political variables (with the exception of LNDUR). The overall picture does not change very much. In particular, LNDUR retains its negative, but not significant coefficient. The model has also been re-estimated after dropping CI (which is a significant determinant of duration), on the grounds that the insignificance of the coefficient of LNDUR could be due to some form of multi-collinearity, but the p-values do not improve considerably.

Finally, both the politico-institutional model and the combined model have been re-estimated using the share of key portfolios received by the formateur (SHK) as the dependent variable rather than the share of all portfolios (SHP). Surprisingly enough, the coefficient of LNDUR becomes positive, but it still remains largely insignificant.[26]An interesting finding which is worth noting concerns the variable SHS. Its estimated coefficient in the regression of SHK significantly decreases compared to the one displayed in the regression of SHP and, more important, the p-value significantly increases, so that the coefficient itself does not pass a zero restriction test at usual levels of confidence. This finding suggests that in the fight over the allocation of key portfolios, parliamentary size does not matter.

[26] For example, in the politico-institutional specification, the WLS estimate of the coefficient is .0.144, with a standard error of .0413, the ML estimate is .0388, with a standard error of .101. The full set of estimates of the model with SHK as the dependent variable is available from the author upon request.

To conclude, the results of this Subsection suggest that there is only weak evidence supporting the theoretical prediction from the first of the two alternative models of political bargaining: the coefficient of the variable LNDUR in the regression of SHP displays the expected negative sign, but it is never statistically different from zero.

4.4 Determinants of the degree of balance of the outcome of negotiations

The second alternative model of bargaining can be characterised in terms of a theoretical prediction about the degree of balance of the outcome of negotiations. In particular, here the expectation is that long negotiations should be associated to relatively balanced outcomes. However, the model also predicts a possible non-linearity in the relationship between duration of the formation process and degree of balance. To the best of my knowledge, no empirical work has been devoted to the analysis of the degree of balance of the political bargaining process.

The first issue to tackle is the definition of the degree of balance. The Appendix will provide some technical details on the computation of this measure. In intuitive terms, the degree of balance can be defined with respect to: (i) the structure of portfolios allocation, (ii) the location on the left-right ideological policy scale of the cabinet as a whole *vis-a'-vis* the location of individual coalition partners. In the first case, one can assume that the outcome is balanced if (a) all coalition partners receive the same share of cabinet posts or if (b) all coalition partners receive a share of cabinet posts which is proportional on a one-to-one basis to their share of coalition seats. Then for each coalition partner the deviation of its actual share from the balanced share it should receive according to either (a) or (b) can be computed. The sum of all these deviations gives a measure of *unbalance*. EVEN1 is the measure of unbalance that refers to the ideal balanced allocation (a), EVEN2 is the measure of unbalance that refers to the ideal balanced allocation (b).

With respect to (ii), the outcome of the bargaining process can be considered as balanced if the location of the cabinet as a whole on the policy space coincides with the median of the distribution of the policy positions of all coalition partners. Once a suitable measure of the location of the cabinet as a whole is identified, the Euclidean gap between this location and the median of the distribution is again an indicator of the degree of *unbalance*. Since there are several possible ways to measure the location of the cabinet as a whole, several possible measures of unbalance based on (ii) can be computed. Here I will make use of two of them, EVEN3 and EVEN4.

All the four measures of unbalance are strictly non-negative and hence the assumption of normality of the distribution is violated once again. A suitable transformation of non-negative variables is the *Box-Cox (or power) transformation* (Box and Cox, 1964):

$$(4.6) \qquad z^{(l)} = \begin{cases} \left(z^{l} - 1\right) / l & \text{for } l \neq 0 \\ \ln z & \text{for } l = 0 \end{cases}$$

where z is a generic variable to be transformed and λ is the parameter that characterises the transformation.[27]

The general form of the Box-Cox regression model can thus be given as:

$$(4.7) \qquad y^{(l)} = a + \sum_{k} b_{k} x_{k}^{(q_k)} + \sum_{j} d_{j} w_{j} + e \qquad \text{with } e \sim N\left[0, s^{2}\right]$$

where y is the dependent variable to be transformed, the x's are the independent variables to which the power transformation has to be applied, the w's are the independent variables to which the power transformation is not applied, α is the intercept term and ε is the stochastic error.

Since I am interested in transformation of the dependent variable only, the restriction $\theta_k = 1$ can be imposed in (4.7). Thus the model I estimate is written, using the more compact matrix notation, as:

$$(4.8) \qquad \mathbf{y}^{(l)} = \mathbf{Xb} + \mathbf{e}$$

where $\mathbf{y}^{(\lambda)}$ is the vector of transformed dependent variables and $\mathbf{X}$ is the matrix of observations on the non-transformed explanatory variables (among which there will be the variable LNDUR), $\mathbf{b}$ is the vector of coefficients β to be estimated and $\mathbf{e}$ is the vector of error terms ε.

Following Sptizer (1982), model (4.8) can be estimated using a log-likelihood algorithm. A note on the interpretation of the coefficients is in order. The *marginal effect* of variable x on y is given by:

$$(4.9) \qquad \frac{\partial y}{\partial x} = \frac{y}{x} \frac{\partial \ln y}{\partial \ln x} = \frac{b_x}{y^{l-1}}$$

where β_x is the estimated coefficient associated to the explanatory variable x. However, since the dependent variable is a measure of unbalance, a *positive* coefficient attached to x implies that higher values of x actually *reduce* the degree to which the outcome can be considered as balanced.

[27] In fact, the Box-Cox transformation can be defined for strictly positive variables. If the variable to be transformed can take value zero (as it is the case in a very few cases for the measures of unbalance) the standard procedure in the literature is to added a small positive constant such that the non-negative variable becomes strictly positive.

As already noted, the second alternative model of bargaining (the one of bargaining directly over policy outcomes) yileds the prediction that long negotiations should lead to more balanced outcomes. However, the model also suggests that the relationship between degree of unbalance and duration could be non-linear and display an inverted U shape. To account for this potential non-linearity, together with the duration of the formation process (LNDUR), the squared duration (LNDURSQ) is included on the r.h.s. of the Box-Cox regression model. A positive coefficient on the linear term and a negative coefficient on the square would be a pattern of results consistent with the theoretical prediction: the degree of unbalance would be increasing with duration at low levels of duration, but the relation would turn negative for longer durations. The results from the estimate of the Box-Cox regression on a sample of 181 cabinets (the coalition cabinets for which a *formatuer* can be clearly identified) are reported in Table 4.

	EVEN1	*EVEN2*	*EVEN3*	*EVEN5*
LNDUR	-.02387	.011982	.27833 *	.23898
LNDURSQ	-.003205	-.007411	-.06793 **	-.0.74991
CARE	-.02265	-.14026	-.44173	-.59479 *
SIZE	-1.6482 ***	-.70728 ***	-1.3883 ***	-.73099
POL	-.45496 ***	.23315	-2.3728 ***	-1.9680 **
FRA	.73839 ***	.94757 **	4.0304 ***	4.7145 ***
CI	-.03683	.04345	.29200 ***	.2352 **
CPG	.071134 *	.027456	.16851	-.10627
CPG (3)	-.034293	.074438	-.06061	.04092
ERG	.86585	1.5728	.07033 **	.07129 *
ERG(3)	-.24713	1.9380	-.04408	-.09045
l	.66391	.421	.23442	.27773

Table 4. Determinants of the degree of balance of the bargaining outcome. There are 181 observations in the sample. Dependent variables are the 5 measures of unbalance described in the text. *** indicates significance at the 1% level, ** indicates significance at the 5% level and * indicates significance at the 10% level. The last row reports ML estimates of the parameter that characterises the power transformation of the dependent variable.

With the exception of the case when the dependent variable is defined as EVEN 1, the coefficients of LNDUR and LNDURSQ are consistent with the expectation of an inverted U shaped relationship. However, in only one case (i.e. when EVEN 3 is the dependent variable) both coefficients are statistically different from zero at usual confidence levels.

The variables that seem to have strongest explanatory power are SIZE (*relative size of coalition partners*), POL (*degree of polarisation*) and FRA (*fragmentation of the legislature*). The variable SIZE takes larger values the more equal is the parliamentary size of different coalition partners. Intuitively, if bargaining occurs among parties of relatively equal size, then the chances of achieving a more balanced outcome should be larger and this can explain the negative coefficient of the variable. The argument for POL and FRA, again refers to the complexity of the bargaining environment. The more complex the environment, the more difficult is to achieve balance. Since FRA is a direct indicator of complexity, then its positive coefficient is not surprising. POL is likely to be an inverse indicator of

complexity since larger values of POL can be associated to a smaller number of alternative viable coalitions. Therefore, the negative sign of its coefficient can be considered as consistent with the ex-ante expectation. In addition to that, the variable CI displays a significant, positive coefficient only when the dependent variable is defined as the Euclidean distance between the location of the cabinet and the median of the distribution of the policy positions of coalition partners. This is not surprising. As a matter of fact, consider that when the degree of unbalance is defined in terms of Euclidean gap, the probability that it takes large values is increasing in the dispersion of the distribution of the policy locations of the parties. CI is a direct indicator of such degree of dispersion and hence it must be positively correlated to unbalance.

The Box-Cox regression model has been re-estimated using dummy variables for duration. In particular, a dummy variable LONG has been defined that takes value 1 if the duration if the formation process is "long".[28] The coefficient on this variable is never significant at usual confidence levels. Results are available upon request from the author.

To summarise, it can be argued that the evidence supporting the theoretical prediction derived from the second of the two alternative models of Section 3 is weak: the signficance of the coefficients of the duration variables LNDUR and LNDURSQ depends on the definition of the variable on the l.h.s.

Section 5. Directions of further research and concluding comments.

This paper has investigated the issue of cabinet formation in coalition systems as a necessary step in the understanding how economic policy is formed in modern representative democracies. Moving from a set of assumptions directly derived from the observation of some stylised facts concerning the social context of government formation, a theoretical model of political bargaining based on the approach of the war of attrition has been constructed. An intuitive discussion of two alternative models of bargaining has also been given. The three models have been compared through an empirical test of their main theoretical propositions. Key findings can be summarised as follows. The duration of the process of cabinet formation is increasing in the degree of dispersion of the policy preferences of coalition partners. This result strongly supports the theoretical prediction obtained from the model of war of attrition. The share of cabinet posts received by the *formateur* party is increasing in the *formateur*'s bargaining strength and decreasing in the degree of complexity of the bargaining environment. However, contrary to what predicted by the first of the two alternative models of political bargaining (the model of bargaining over the allocation of a cake), there is no statistically significant relationship between the share of the formateur and the duration of the process. Furthermore, when the dependent variable is

[28] A "long" duration is one which (i) is above the country-mean or (ii) is above the country median or (iii) is above the country mean plus one standard deviation. All three definitions have been used.

defined as the share of key portfolios (rather than of all portfolios) received by the formateur, the parliamentary size of the formateur plays no significant role. Therefore, the outcome of the fight over the allocation of key portfolios is independent from parliamentary size, a result also incorporated in the theoretical model of war of attrition. Finally, a few determinants of the degree to which the bargaining outcome can be defined as balanced have been identified. Again, an important role is played by the variables reflecting the complexity of the bargaining environment. There is also some weak evidence that the relationship between the degree of balance of the outcome of the process and the duration of the process itself might be non-linear. Such a result would be consistent with the theoretical prediction from the second of the two alternative models (the model of bargaining directly over policy outcomes); however, it does not appear to be robust to changes in the defintions of the dependent variable. All the above findings are obtained controlling for the possible impact of economic variables.

A natural extension of the research in this area is the analysis of the impact of political biases in economic policy formation. Some form of political bias is likely to be reflected into the structure of portfolios allocation. A clear point made throughout this paper is that policy outputs are heavily affected by the policy preferences of the parties in control of the key portfolios. Therefore, when studying the impact of ideological bias (one of the possible forms of political bias) on economic policy choices it is important to look at the ideological location on the policy space of the parties in control of the key portfolios, independently from the location of the coalition as a whole. The two locations might be correlated, but not necessarily identical. Moreover, since the fight over the control of key portfolios does not necessarily depend upon the parliamentary size of the parties, it can well be the case that relatively small parties will end up affecting the process of policy formation to a large extent. More generally, there is no guarantee that the outcome of the political bargaining process is such that policy outcomes will reflect the preferences of the median voter. I am currently working on these issues and I have already obtained some preliminary econometric results that confirm the existence of clear ideological bias in policy formation when the preferences of the parties in control of key portfolios are explicitly taken into account. Moreover, it seems that the location of the median voter on the policy space is often significantly different from the one of these parties so that the policy orientation of the cabinet does not reflect the one of the median voter. Of the two, the one which has most explanatory power in the regression of fiscal policy instruments is for sure the policy orientation of the cabinet. That is, it seems that, when not consistent with those of the parties controlling key portfolios, the preferences of the median voter matter very little.

Appendix: Measures of the degree of *unbalance* of the outcome of the bargaining process.

Let s_i be the share of cabinet posts received by generic party *i* and p_i its share of coalition seats. Then, given that there are *n* partners in the coalition, EVEN 1 and EVEN2 are defined as:

(A.1a) $EVEN1 = \sum_{i=1}^{n} \left| s_i - \frac{1}{n} \right|$ (A.1b) $EVEN2 = \sum_{i=1}^{n} |s_i - p_i|$

Let now θ_i be the location of party *i* on the [1,10] left-right policy space (i.e. θ_i is a number included between 1 and 10, where 1 is extreme left and 10 is extreme right) and f_i the proportion of key portfolios (including the office of Prime Minister) held by party *i* (eventually f_i might be equal to zero for some coalition partners). Two of the several possible definitions of location of the cabinet as a whole can be given as follows:

(A.2a) $LOC1 = \sum_{i=1}^{n} \{ s_i q_i \}$; (A.2c) $LOC2 = \sum_{i=1}^{n} \{ f_i q_i \}$

If *M* is the median of the distribution of the θ's of all coalition partners, then the Euclidean gap between LOC1 and M is EVEN3 and the Euclidean gap between LOC3 and M is EVEN4.

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