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RATIFICATION REQUIREMENT AND BARGAINING POWER

BY HANS HALLER AND STEINAR HOLDEN

Virginia Polytechnic Institute and State University, U.S.A.
University of Oslo, Norway

When a large group of people is affected by a bargaining outcome, practical reasons often require that the group be represented by an agent in the bargaining. This paper addresses the issue of how the group ensures that the agent reaches an agreement that satisfies the group. We show that by adopting a super-majority ratification rule, the group may improve its bargaining position and obtain a larger share of the bargaining surplus. However, a super-majority ratification rule also involves the risk that a beneficial agreement is rejected by a minority of the group.

1. INTRODUCTION

In many bargaining situations, like international negotiations or collective bargaining, large groups of people are affected by the outcome of negotiations. Clearly, for practical reasons a large group must be represented by one (or several) agents, negotiating on behalf of the large group. An important issue then is how the group may ensure that the agent reaches an agreement that benefits the group. This paper discusses one specific measure that the group may use, namely a ratification requirement stipulating that the agreement reached by the agent be subject to voting by the group on whether to accept the agreement. We analyse the decision of the group ahead of negotiations, when the size of the surplus to be shared is unknown. Will the group want a ratification requirement, and if it does, how large a majority should be required? Moreover, we consider the consequences on the bargaining outcome of a ratification requirement.

Ratification requirements are used in many different types of negotiations. In the case of collective bargaining, the proposed agreement is often subject to a vote among the affected members or a representative committee. In many countries, an international treaty must be supported by a majority (often more than 50 percent) of votes in the parliament, or by a popular referendum, before it becomes binding for the country. In corporations, stockholders must ratify takeover and merger decisions.

In our analysis, group members are assumed to be heterogeneous with respect to their reservation utilities, that is, their utility if no agreement is reached. A group

* Manuscript received May 1994; revised October 1996.
† Email: haller@vt.edu; steinar.holden@econ.uio.no
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member supports an agreement only if the gain from the agreement is at least as
great as his reservation utility. Moreover, an agreement is only accepted if it is
supported by a fraction of the group that is sufficiently large to meet the ratification
requirement. Thus, to each level of ratification requirement, one can associate a
critical minimal value that the gain from the agreement has to reach to get an
agreement accepted. It turns out that, under certain circumstances, a ratification
requirement is adopted if it is in the interest of the group’s median voter. In this
case the adopted ratification requirement results in the critical value that maximises
the expected utility of the median voter.

In the choice of how large a majority should be required for ratification of an
agreement and, thus, the choice of the critical value, two opposing effects are at
work. Giving a small minority the right to veto a possible agreement implies that
only a very favourable agreement is possible. On the one hand, this may be
advantageous because it could make the opponent offer a very favourable solution
which gets accepted. On the other hand, the requirement of a large majority to
ratify an agreement also involves a risk that a mutually beneficial agreement cannot
be made, because any offer the opponent is willing to make would be turned down
by a minority.

Two examples may illustrate these effects of a ratification requirement. On 8 June
1994, the 28 owners of U.S. major league baseball adopted a super-majority
ratification rule for labour agreements with players. The Washington Post (June 9,
p. D1) writes, “With a history of caving into the players during seven previous labor
confrontations, owners also ratified an important change in the Major League
Agreement. Now during a strike, any labor agreement must be approved by three
quarters of the 28 owners instead of simple majority. So only eight owners are
needed to block a settlement, and there appears to be at least eight so-called hard
liners who apparently are willing to shut down the game in midseason rather than
compromise significantly.”

A second example is the distinction in the U.S. Constitution between interna-
tional treaties and ordinary decisions. A majority of two-thirds in the U.S. Senate is
necessary to make international treaties valid, whereas ordinary domestic decisions
only require a simple majority. It is clear that the stricter requirement for interna-
tional treaties involves a risk that a proposed treaty is rejected in spite of a clear
majority (but less than two-thirds) in favour of it. On the other hand, there is also a
possibility that other countries offer the U.S. more favourable terms, just because of
the difficulties in obtaining the necessary majority. This view is indeed shared by
observers in the U.S. executive branch itself. To cite Vernon (1993): “Moreover, the
U.S. executive branch itself, when conducting an international negotiation over an
economic policy, has been known to regard the independence of Congress as a
negotiating advantage. At times, Congress’ independence enables U.S. negotiators
to threaten the representatives of other countries with the possibility of congres-
sional displeasure and retribution if the other countries do not accept their
proposals.”

Our analysis of ratification requirements is related to previous literature on
measures to improve a party’s bargaining position. Schelling (1960), Ashenfelter and
Johnson (1969), and Crawford (1982) show that commitment to an ambitious
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demand may have this function. Compared with this literature, the contribution of the present paper lies in the analysis of an explicit and novel means of commitment.

This paper does not provide the first explanation of why there might exist ratification requirements. O'Flaherty (1990) suggests that a majority rule is a good way to aggregate information in a principal–agent problem with many principals. In a discussion of ratification of collective bargaining agreements, Summers (1967) emphasizes that ratification by the members entails democratic control, in the sense that it ensures that the agreement is acceptable to the members themselves. Summers (1967) also mentions the additional benefit that the workers feel more bound by an agreement on which they have voted themselves. Caplin and Nalebuff (1988) propose a two-thirds majority rule to prevent electoral cycles (à la Condorcet) that might allow several conflicting proposals to all receive the support of a simple majority. Hylland (1994) discusses the use of super-majority requirements as a means of protection for the rights of minority groups. Cappelli and Sterling (1988) argue that unions may gain from a ratification requirement because without ratification, the union leaders would have had to explore more thoroughly the preferences of the members in advance of the negotiations. This would involve a risk of leakage to the management of the firm, which could weaken the bargaining position of the union.

We believe that these explanations, as well as ours, are of relevance for the choice of ratification requirements in real world negotiations, although the importance of each explanation clearly varies with the issue at hand. Note, however, that although the choice of having a ratification requirement may well be based on other arguments, the choice of how strict it should be may still be influenced by the arguments in this paper. Furthermore, our analysis of the effects of a ratification requirement is valid irrespective of the actual reason for having a ratification requirement.

The remainder of the paper is organised as follows. Section 2 sets out the basic framework, where only one of the parties is represented by an agent in the bargaining. Here, the reservation utilities are known when the ratification requirement is decided. This case may represent a situation where the ratification requirement applies to one specific negotiation, or many similar negotiations, and the individuals are fairly well informed about the possible outcomes (e.g., the baseball league example above). This section serves as an introduction to the model in Section 3, where both parties are groups. However, it is also of independent interest, for example, as a description of wage negotiations between a union and the management of the firm, or possibly of negotiations between a democratic and a dictatorial government, where the former represents a group.

In Section 3, we extend the model so that both parties are groups, each represented by an agent in bargaining. Section 4 deals with the case where the individuals do not know their reservation utility at the time of determination of the ratification requirement; they only know the common probability distribution for all individuals. Thus, the individuals are identical ex ante, while they are diverse ex post. This analysis may be applicable for a ratification requirement specified in the Constitution (as in the example with the U.S. Constitution), which is meant to apply to all future negotiations of a certain type. Section 5 discusses alternative
means of commitment and provides evidence on the use of ratification requirements in practice. Section 6 concludes. All proofs are in the Appendix.

2. THE BASIC MODEL

Many of the negotiations to which our analysis is meant to apply deal with several issues. In a heterogeneous group, the individuals will in general differ with respect to the evaluation of each issue. Moreover, the individuals may also differ in their evaluation of the consequences of there being no agreement in the negotiations. In advance of negotiations, there will be uncertainty along both these lines. However, over time information will be revealed and some of the uncertainty disappears. We will choose a very crude specification of this highly complex situation. There is bargaining between two parties about the division of a surplus, represented by a scalar variable, \( s \). \( s \) is assumed to be unknown before the negotiations, but with a known probability distribution. More precisely, \( s \) is assumed to be uniformly distributed on the interval \( S = [0, 1] \). The range and position of this interval is clearly just a choice of measurement scale, and involves no loss of generality. The crucial assumption is the uniform distribution, which will be discussed below.

One of the parties is a group consisting of a continuum of individuals, and this group is represented by an agent in the bargaining. An agreement in the bargaining is a real number \( \alpha \in [0, s] \), which gives each individual in the group a utility \( \alpha \) (so all individuals in the group obtain the same utility from a given agreement). The other party is a single individual, referred to as player 2, who obtains utility \( s - \alpha \) from an agreement on \( \alpha \).

The heterogeneity in the group is captured by their reservation utilities \( t \), that is, their utilities if no agreement is reached. The reservation levels \( t \) are uniformly distributed on an interval of length \( T > 0 \), with centre \( t' \). Choosing a uniform distribution has the advantage that it yields an explicit formula for the optimal ratification requirement. (We show below that the main results hold with much less restrictive assumptions on the distribution of \( t \).)

The interval has endpoints \( t_B = t' - T/2 \) and \( t_U = t' + T/2 \). The cumulative distribution function is \( F(t) = (t - t_B)/T \) for \( t \in [t_B, t_U] \). To avoid boundary cases, we assume \( t' < 1 < t' + T \). (If \( t' \geq 1 \) = maximum value of \( s \), there is no need for negotiations.)

The agent that undertakes the actual negotiations for group 1 also has a linear utility function, and this agent’s and player 2’s disagreement points are set equal to the lowest possible value of \( s \), that is, 0. The interpretation of this assumption is that both the agent and player 2 just want the best possible agreement, with no explicit minimal requirements. We may think of the agent as a full time employee, say a career diplomat, who happens to be assigned to the negotiating task, and who just wants to do a good job in negotiating the agreement.\(^2\)

\(^2\) In Section 5 below, we discuss the possibility of a strategic use of the agent. Note that the agent in our model has a more passive role than the agent in our example about the U.S. Constitution in the Introduction, where the executive branch is the agent.
The sequence of moves in the model is the following (under the implicit assumption of the presence of all group members whenever a vote takes place):

**Stage 1.** The group votes on whether they want to institute a ratifying majority \( f \in (0, 1) \), so that an agreement will only be valid if at least a fraction \( f \) of the group votes in favour of the agreement. If the group does want to require a ratifying majority, it then decides what this required majority should be. In both votes a simple majority (50 percent plus one vote) is required for a proposal to pass.

**Stage 2.** The size of \( s \) is realised and there is bargaining between the agent representing the group and player 2; the outcome of the bargaining is given by the Nash bargaining solution.\(^3\) (We abstract from possible uncertainty in the bargaining; uncertainty in the bargaining is an important issue, but it is not the topic of the present paper.)

**Stage 3.** (If there is a required ratifying majority). The group votes on the proposed agreement. The agreement is valid if at least a fraction \( f \) of the group votes in favour of the agreement.

We solve the model backwards, first analysing stage 3. Clearly, an individual in the group with reservation level \( t \) votes in favour of the agreement \( \alpha \) if \( \alpha \geq t \), against it if \( \alpha < t \). Thus, if there is a required majority \( f^* \), then there will exist a critical value \( t^* \), determined by \( f^* = F(t^*) \), such that the fraction that votes in favour of the agreement will be greater than or equal to \( f^* \) if and only if the agreement is \( \alpha \geq t^* \). \( f^* = 0 \) represents the case with no ratification requirement.

We then turn to the bargaining at stage 2. Both parties are aware of the required ratifying majority of the group, and they know that an agreement on less than \( t^* \) will be rejected. Thus, player 2 is willing to give the group more than the share given by the Nash bargain, if i) this is necessary to make the agreement acceptable to the group, and ii) the agreement still is profitable for player 2. Thus, if \( t^* > s \), no agreement is reached and we set \( \alpha = \alpha(s, t^*) = 0 \). Otherwise,

\[
\alpha = \arg \max_{\alpha \in [t^*, s]} \{ \alpha (s - \alpha) \}
\]

The solution to (1) is \( \alpha = \alpha(s, t^*) = s/2 \) if \( s/2 \geq t^* \), and \( \alpha = \alpha(s, t^*) = t^* \) if \( s/2 < t^* \leq s \). Hence an individual in the group with reservation level \( t \) obtains utility

\[
u(t, t^*) = \begin{cases} 
  s/2 & \text{if } s/2 \geq t^*, \\
  = t^* & \text{if } s/2 \leq t^* \leq s, \\
  = t & \text{if } s < t^*.
\end{cases}
\]

\(^3\) The qualitative results do not depend on this particular bargaining solution.
Figure 1 shows the potential gains and losses (in expectational terms) from having a ratification requirement. At stage 1, there is voting in the group on the ratification requirements. We have the following

**Proposition 1.** The outcome of the voting will be a ratification requirement that maximises the expected utility of the median voter. More specifically:

(a) If $0 < t' < 1$, the required ratifying majority is unique and exceeds 50 percent: $f^* = F((t' + 1)/2) = 1/2 + (1 - t')/(2T) > 1/2$. The corresponding critical value is $t^* = (t' + 1)/2 > t'$.

(b) If $t' = 0$, the median voter is indifferent between no ratifying vote and any requirement in the range $F(0) \leq f^* \leq F(1/2)$. The median voter is opposed to any $f^* > F(1/2)$.

(c) If $t' < 0$, the median voter is opposed to any requirement that is sometimes binding, i.e., where $f^* > F(0)$.

The property that the median voter decides is based on the fact that (cf. appendix)

(i) for $t > 0$, $E[u(t, t^*)]$ is single-peaked in $t^*$ and the location of the peak, $t^*(t)$ is monotone in $t$ with $\lim_{t \to 0} t^*(t) = 1/2$;

(ii) for $t = 0$, $E[u(t, t^*)]$ is constant up to $t^* = 1/2$ and declining thereafter;

(iii) for $t < 0$, $E[u(t, t^*)]$ is constant up to $t^* = 0$ and declining thereafter.

Proposition 1 shows that in the typical scenario where the median voter benefits from a good agreement but loses from a bad one (i.e., $0 < t' < 1$), the median voter chooses a unique ratification requirement $f^*$ that is larger than 50 percent, with a corresponding critical value $t^* > t'$. The group will sustain the median voter’s desire for a super-majority requirement. The super-majority requirement will enhance the group’s bargaining power, but at the risk of precluding some agreements which would benefit the median voter.
The critical value \( t^* \) is an increasing function of the reservation utility of the median voter, \( t' \), which conforms with the intuition that higher reservation utility makes a person more aggressive. The required majority \( f^* \) is, however, decreasing in \( t' \), which may at first seem counterintuitive. The interpretation of this result is that an increase in \( t' \) moves the whole distribution of reservation values upwards, including the reservation utility of any given majority requirement. This makes it necessary to reduce the required majority, otherwise the possibility of rejecting an advantageous agreement would be too likely.

If the reservation utility of the median voter is sufficiently low (\( t' < 0 \)), the risk that a ratification requirement may prevent an agreement will induce the median voter to choose not to require ratification: \( f^* = 0 \). Intuitively, requiring a majority slightly above 50 percent will in this case be to little avail, as \( t^* \) would still be close to 0 (the worst possible agreement). On the other hand, choosing a majority considerably above 50 percent would be too risky in the sense that advantageous agreements might be rejected. For one particular reservation utility, \( t' = 0 \), the median voter is indifferent between no ratification vote and any ratification requirement in the range \( F(0) \leq f^* \leq F(1/2) \) (with corresponding critical value \( t^* \in [t', 1/2] \)), as the expected benefit from increased bargaining power is exactly offset by the expected loss due to the risk of foregoing advantageous agreements.\(^4\)

Several points are worth noting. First, observe that the critical value \( t^* \) is independent of the measure of group heterogeneity, \( T \).\(^5\) This reflects the choice of \( t^* \), as a means of maximising the expected utility of the median voter—the reservation utilities of the rest of the group are irrelevant for this maximization. However, the heterogeneity of the group does affect which ratification requirement the median voter must choose to implement the optimal \( t^* \). In the interesting interval, where the ratification requirement satisfies \( f^* \in [1/2, 1] \), \( f^* \) is decreasing in \( T \). Thus, greater heterogeneity (measured by the length of the interval \( T \)) results in a more moderate requirement \( f^* \).

Secondly, observe that the chosen ratification requirement is inefficient, in the sense that it does not maximise the sum of the ex ante expected payoffs of the median voter and of player 2, the two distinguished actors.\(^6\) We will compare the efficiency of a ratification requirement of Proposition 1, \( t^* = (t' - 1)/2 \), with a 50 percent requirement, \( t' = t^* \). The stricter requirement entails an efficiency loss whenever \( t' < s < t^* \), when a mutually beneficial agreement will not be concluded. The ex ante expected efficiency loss with the super-majority ratification requirement is

\[
\frac{1}{F'} \left( (t'-1)/2 \right) (s - t') \, ds = \frac{(1 - t')^2}{8} > 0.
\]

\(^4\) The existence of a range of optimal ratification requirements for \( t' = 0 \) is a special feature that hinges on the assumption of uniform distributions.

\(^5\) As the choice of parameters in the distribution of the surplus essentially is a choice of measurement scale, \( t' = 1/2 \) measures the mean of the reservation utilities relative to the expected surplus, while \( T \) measures the heterogeneity of the reservation utilities relative to the uncertainty of the surplus.

\(^6\) Maximising the utility of the median voter is equivalent to maximising the mean expected payoff of the group members, because of the linearity of the model.
An implication of our specific model also deserves to be mentioned. Note that under the assumptions of Proposition 1, the median voter uses the ratification requirement aggressively by choosing a super-majority requirement unless his reservation utility is so low that he benefits from all possible agreements. This conceals that under other assumptions the median voter may not gain from setting a super-majority requirement, yet he might gain from having a 50 percent requirement. In fact, irrespective of choice of distribution functions, the median voter will set at least a 50 percent requirement if there is a possibility for a disadvantageous agreement, that is, if the reservation utility of the median voter exceeds both the lowest possible value of \( s \) and the disagreement point of the agent. (This is exemplified in Section 3 below, where both parties are groups.)

\textit{Weaker Assumptions on the Distributions of Reservation Utilities.} The previous analysis can be extended to a much larger class of distributions of reservation levels. Namely, let \( t \) be continuously distributed on a nondegenerate interval \([t_B, t_U]\) of length \( T = T_U - T_B \) with (continuous) cumulative distribution function \( F \), strictly positive density on \((t_B, t_U)\), mean \( \bar{t} \), and median \( t' \). Moreover, we maintain the convenient assumption that boundary cases are excluded, which means \( t' < 1 < 2t_U - t' \). It turns out that the result concerning the ratification requirement \( f \) in Proposition 1 still holds, while we can no longer quantiﬁe the corresponding value for \( t^* \). This assertion follows immediately from the proof of Proposition 1.

\textit{Weaker Assumptions on the Distribution of Surplus.} Our analysis is much more sensitive with respect to the distributional assumptions on the surplus, \( s \). As pointed out above, the normalization to the unit interval \([0, 1]\) involves no loss of generality. The crucial assumption is the uniform distribution of \( s \). It guarantees the validity of the median voter approach, in particular the facts (i)–(iii) reported earlier, regarding the expected utilities \( Eu(t, t^*) \). For arbitrary distributions of \( s \), these facts need no longer hold.

The result that the median voter will want a super-majority requirement is, however, robust. Consider the general case where \( s \) is distributed on the interval \( S = [0, 1] \), with cumulative distribution function \( H(s) \) and continuous and strictly positive density \( h(s) \). The expected utility of the median voter is

\begin{equation}
E[u(t', t^*)] = t' H(t^*) + t^* [H(2t^*) - H(t^*)] 
+ E[s/2|s > 2t^*] (1 - H(2t^*))
\end{equation}

as long as \( 2t^* \leq 1 \) (the last term vanishes if \( 2t^* > 1 \)). The first term \( t' \) corresponds to the utility if there is no agreement, the second term \( t^* \) to the utility if the ratification requirement binds, while the third term \( E[s/2|s > 2t^*] \) corresponds to the conditional expected utility if the surplus is so large that the ratification requirement does not bind, where all terms are multiplied by the probability that the relevant situation arises. It is clear that an optimal \( t^* \) for the median voter exists, since the median voter's expected utility is a continuous function of \( t^* \) on a compact interval \([t_B, t_U]\). Furthermore,

\begin{equation}
dE[u(t', t^*)]/dt^* = (t' - t^*) h(t^*) + H(2t^*) - H(t^*),
\end{equation}
where the first term reflects the expected loss due to the increased risk of no agreement, while the second term reflects the improvement in the agreement if the ratification requirement binds. We see from (5) that $dE[u(t', t^*)/dt^*] > 0$ if $0 < t^* \leq t' < 1$. The following Proposition is immediate.

**Proposition 2.** Any voter with reservation utility $0 < t < 1$ will want $t^* > t$. Thus, the median voter will want a ratification requirement above 50 percent. Note, however, that the optimal $t^*$ is not necessarily unique.

As observed above, without the assumption of a uniform distribution, we can no longer be certain that the median voter will prevail. The intuitive reason for this is that when $s$ has a nonuniform distribution, the expected utility as a function of the critical value may have several peaks. In this case voters with a lower reservation utility than the median voter may in fact prefer a higher critical value than one that is optimal for the median voter, with the consequence that an optimal critical value for the median voter may be defeated in a vote. We can, however, be certain that the median voter will prevail under somewhat weaker assumptions on the distribution of $s$ than uniformity.

**Proposition 3.** Let $t_R$, $t_U$, and $F$ be as stated before. Moreover, let the median group member $t'$ satisfy $1/2 < t' < 1$. Suppose that the density $h$ is continuously differentiable with $h > 0$ and $h' \geq 0$. Then the group adopts the super-majority ratification rule $t^* = F(t^*(t'))$, determined by the unique critical value $t^*(t')$, that maximises the median voter’s expected utility.

The proposition basically says that if $s$ has a nonvanishing, smooth, and increasing density, and if the median reservation level is sufficiently large, then a super-majority will be required. Intuitively, the conclusion is plausible, since the hypothesized distributional properties imply that under a modest super-majority requirement, a majority runs only a small risk of foregoing a beneficial agreement.

3. **Both Parties Are Groups**

We now extend the model so that both parties are large groups, each represented by an agent in the bargaining, while returning to the initial assumptions on surplus and reservation utilities (i.e., uniform distributions). Assume first that both parties have a ratification requirement. Let $t^*$ and $r^*$ denote the critical values for the two parties implied by the vote at stage 3. The bargaining outcome at stage 2 is still assumed to be determined by the Nash bargaining solution. Thus, as long as $t^* + r^* \leq s$,

$$
(6) \quad \alpha = \arg \max \{ \alpha (s - \alpha) | \alpha \in [0, s], \alpha \geq t^* \text{ and } s - \alpha \geq r^* \}.
$$

The solution to (6) is $\alpha = s/2$ if $s/2 \geq t^*$ and $s/2 \geq r^*$; $\alpha = t^*$ if $s/2 \leq t^* \leq s$ and $s - t^* \geq r^*$; $\alpha = s - r^*$ if $s/2 \leq r^* \leq s$ and $s - r^* \geq t^*$; while no agreement will be reached if $t^* + r^* > s$. An individual in the first group with reservation level $t$
obtains utility

\[
\begin{align*}
    u(t, t^*, r^*) &= \alpha = s/2 & \text{if } s/2 \geq t^* \text{ and } s/2 \geq r^*, \\
    &= \alpha = t^* & \text{if } s/2 < t^* \leq s \text{ and } s - t^* \geq r^*, \\
    &= \alpha = s - r^* & \text{if } s/2 < r^* \leq s \text{ and } s - r^* \geq t^*, \\
    &= t & \text{if } s < t^* + r^*.
\end{align*}
\]

As before, the median voter in each group will choose the ratification requirement that maximises his expected utility, given the other group's requirement. A pair of critical values \((t^*, r^*)\) is an equilibrium pair if it satisfies the mutual maximization property for the two median voters. In more technical terms, such a pair \((t^*, r^*)\) is an equilibrium point of the strategic game played by the two median voters who pick \(t^*\)'s and \(r^*\)'s, respectively, whose expected payoffs are determined by (7) (with \(t = t'\)) and its symmetric analogue (with \(r = r'\)).

First of all, let us observe that, as in many strategic situations, mutual obstruction is trivially an equilibrium outcome:

**Proposition 4.** If \(t' \in [0, 1]\), \(r' \in [0, 1]\), then every pair \((t^*, r^*)\) such that \(t^* \in [1 - r', 1]\) and \(r^* \in [1 - t', 1]\) constitutes an equilibrium pair of critical values.

The intuition is clear: if one party prevents all beneficial agreements, the other party may do the same.

Subsequent analysis is directed towards the more interesting cases where \(t^* < 1 - r'\) and \(r^* < 1 - t'\). We first characterise all nontrivial equilibria when the groups are identical, \(t' = r'\).

**Proposition 5.** If \(1/2 > t' = r' \geq 0\), then the nontrivial equilibrium critical values are

\[
    r^* = r', \quad \text{and} \quad t^* \in [t', 1/2];
\]

or

\[
    t^* = t', \quad \text{and} \quad r^* \in [r', 1/2].
\]

Thus, there is a unique (nontrivial) symmetric equilibrium, and a multiplicity of asymmetric equilibria. The symmetric equilibrium shows, in contrast to the suggestion from the single group case of Proposition 1, that both parties may choose simple majority requirements, 50 percent, (as \(t^* = t'\)). The main motivation for requiring ratification of a simple majority is to prevent disadvantageous agreements. The 50 percent requirement also has an additional function: in equilibrium it can prevent the other party from exploiting possible weakness by setting a strict requirement. However, this prevention is not complete, because if one party sets a 50 percent requirement, the other party is indifferent between 50 percent requirement and an interval of stricter requirements, \(r^* \in [r', 1/2]\), which is reflected in the
existence of a range of asymmetric equilibria. Technically, the asymmetric equilibria
correspond to the range of optimal requirements of Proposition 1(b). Thus, their
existence hinges on the uniform distribution.

We now turn to the asymmetric case where \( t' > r' \).

**Proposition 6.** If \( 1/2 \leq t' > r' \geq 0 \), then the nontrivial equilibrium critical
values are

\[
    r^* = r', \quad \text{and} \quad t^* = (t' + 1 - r^*) / 2.
\]

Thus, if one group has a better bargaining position than the other, in the sense of
having a higher reservation utility, the consequences of this asymmetry are magni-
fied by the possibility of having a ratification requirement: the stronger group (group
1) will play more aggressively (set a higher critical value), and thus obtain a larger
payoff. The intuition is that the stronger party has less to lose if there is no
agreement, and is therefore more willing to risk that no agreement is reached. The
higher is the reservation utility of the stronger median voter, the stricter a ratifica-
tion requirement will be chosen (as in the case with only one group, cf. Proposition
1). The weaker party sets a 50 percent ratification requirement, \( r^* = r' \), as a
defensive measure to prevent disadvantageous agreements. Technically, this case
corresponds to the case where only one party makes strategic use of a ratification
requirement, and where \( t' > 0 \) (cf. Proposition 1).

Propositions 5 and 6 show that the possibility of ratification requirements has a
number of implications for bargaining situations. First, as shown by Proposition 6, a
ratification requirement magnifies asymmetries, because a ratification requirement
is a more potent measure for the stronger part. Small differences (\( t' \) slightly greater
than \( r' \)) leads the stronger group to take a more aggressive position, with possibly
stark effects on the outcome. Secondly, ratification requirements have opposing
effects on the payoff of the median voter (the risk of preventing advantageous
agreements versus gain in bargaining power). This involves considerable instability
in the outcome of the negotiations. The payoffs are not continuous functions of the
parameter values, and a slight increase of the reservation utility of one of the
median voters, from \( t' = r' - \varepsilon \) to \( t' = r' + \varepsilon \), changes the outcome from an asym-
metric equilibrium favouring one group to an asymmetric equilibrium favouring the
other. Even when the parties are symmetrical, there exist asymmetric equilibria,
which is in contrast to standard bargaining theory.

Thirdly, ratification requirements also have interesting implications for efficiency.
The symmetric equilibrium (\( r^* = t^* = t' = r' \)) is efficient in the sense that the sum of
the ex ante expected payoffs of the two groups is maximised. However, the
asymmetric equilibria are inefficient, as there is a risk that the stricter ratification
requirement set by one group precludes a mutually beneficial agreement. In the
asymmetric equilibria with identical groups (Proposition 5) the efficiency loss is
borne entirely by the party with the lower critical value. The party with the higher
critical value is indifferent to the size of its critical value (within the specified
interval), as the increase in risk of no agreement from a higher critical value is
exactly offset by the improvement in bargaining position.
Informally, we now also discuss a small but possibly important extension of the model in Section 3. Consider the case where the ratification requirements are set when both groups (the median voters) know the distribution of reservation utilities in their own group, and the distribution of the joint surplus \( s \), but without knowledge of the reservation utilities of the other group. All reservation utilities, ratification requirements and the value of \( s \) are revealed before the bargaining takes place. It is immediate from Proposition 6 that a median voter should choose a 50 percent requirement if he expects the other median voter to have a higher reservation utility than himself, and a super-majority requirement if he expects the other median voter to have a lower reservation utility than himself. If both groups are optimistic and choose a super-majority requirement, it is likely that no agreement can be concluded.

4. CONSTITUTIONAL RATIFICATION REQUIREMENT

In the previous sections, a single negotiation has been considered. Now we consider the institution of a constitutional ratification requirement, supposed to hold for many conceivable future treaty negotiations. Our foregoing analysis is immediately applicable to this case, if each group member has an invariable reservation level, regardless of the subject of negotiations. By and large, collective bargaining may fall into this category. Of course, a union member’s reservation utility may change during his life or career cycle. But as long as those changes can be foreseen, a similar, though more complicated analysis can be performed, with similar qualitative conclusions. But what if the typical scenario prevails, that is, group members’ reservation levels vary with the topic of negotiation? It turns out that under certain conditions, our foregoing analysis can be adapted to such a scenario. In what follows, we allow for ex ante uncertainty about both the size of the surplus and group members’ reservation levels. Formally, there is still a single future negotiation; but now there exists more uncertainty ex ante, with regard to the relevant parameters for this negotiation. The case of multiple (simultaneous or sequential) negotiations could be modelled explicitly by means of more cumbersome notation.

For the sake of simplicity and transparency, we consider a modification of the basic model of Section 2. When a constitutional ratification clause has to be decided upon, a group member’s future reservation level is uncertain: it is a random variable with realizations in the nondegenerate interval \( J = [t_B, t_U] \). The group is represented by a nondegenerate interval \( I = [i_B, i_U] \), with generic member \( i \). Ex ante, both the surplus to be shared and each individual’s reservation level may be uncertain. To express this twofold uncertainty, we introduce a probability space \((\Omega, \Sigma, P)\) and measurable mappings \( \sigma : \Omega \to S \) and \( \tau : \Omega \times I \to J \). (For concise definitions, consult Bauer 1981, Hildenbrand 1974, or Folland 1984). Ex post, the bargaining situation with respect to a specific treaty is determined by the realized state of nature \( \omega \in \Omega \): the surplus to be shared is \( s = \sigma(\omega) \); for generic group member \( i \), the reservation level is \( t_i = \tau(\omega_i, i) \). Inspection of the corresponding part of the proof of Proposition 1 reveals that \( i \)'s expected utility derived from a critical value \( t^* \) conditional on \( t_I \) is linear in \( t_i \). Therefore, \( i \)'s ex ante assessment of \( t^* \)
depends only on \( \bar{t}_i \), the expected value of \( t_i \). The distribution of members (names, addresses) \( i \in I \) which, by Skorokhod’s Theorem, we may assume uniform without any loss of generality, induces a distribution of expected or mean reservation levels \( \bar{t} \in J \).\(^7\) We proceed under the assumption that the surplus \( s \) and the mean reservation levels \( \bar{t} \) are independently distributed. Then the formal analysis as regards an individual’s most preferred critical level is reduced to that of the basic model of Section 2, except that reservation levels are replaced by mean reservation levels. Our central result is:

**Proposition 7.** Suppose the reservation levels are identically distributed for all individuals with common continuous cumulative distribution function \( F \), common strictly positive density, and common mean reservation level \( \bar{t} = \bar{t}_i \) for all \( i \). Suppose further that \( 0 < \bar{t} < 1 \) and boundary cases are avoided. Finally, let the distribution of the surplus be independent of reservation levels.

(a) If the surplus is uniformly distributed on \( S \), then all group members unanimously endorse the required ratifying majority \( f^* = F((\bar{t} + 1)/2) > 1/2 \).

(b) If the surplus has a continuous and strictly positive density, then the group unanimously endorses a required ratifying majority of more than 50 percent.

(a) is the direct counterpart to Proposition 1.\(^8\) Incidentally, if \( J = [t_B, t_U] = [0, 6/5] \), each \( t_i \) is uniformly distributed on \( J \), and if (a) applies then \( \bar{t} = 3/5 \), \( t^* = 4/5 \) and \( f^* \) equals \( 2/3 \), the U.S. provision mentioned in the Introduction.

(b) corresponds to Proposition 2 about the median voter preferring a super-majority requirement without assuming that the surplus \( s \) is uniformly distributed. In contrast to the case analysed in Proposition 2, we may here be certain that the super-majority requirement will indeed be chosen; all group members are identical ex ante, so the possibility of Proposition 2 that the median voter is defeated clearly is irrelevant.

We are now going to show that the hypothesis of Proposition 7 can be fulfilled. To this end, we elaborate on a construction that has been suggested to us by Wilfred Ethier and yields nonzero, nonlinear correlation of reservation levels across individuals.\(^9\) Assume that \( s \) is on \( S = [0, 1] \) with cumulative distribution function \( H \) and

---

\(^7\) For convenience we drop the subscript \( i \) whenever this does not cause any ambiguity.

\(^8\) It has been noted before that when uncertainty is introduced into spatial voting models, the median of the distribution of voter ideal points (bliss points) may lose its pivotal role. Then the equilibrium alternative can be the median or the mode, the mean, a higher moment, or some other point. See Hinich (1977, 1978), Ledyard (1984, pp. 27, 28). In the context of that earlier literature, a shift of the equilibrium point occurs after the underlying von Neumann-Morgenstern utility function or, more specifically, the function measuring the distance between an alternative and a voter’s bliss point, has been subject to a nonlinear (nonaffine) monotone transformation. In the present context, we abstain from transforming von Neumann-Morgenstern utility functions (cardinal utilities). So no change in ‘risk preferences’ occurs. Rather, additional uncertainty makes group members ex ante identical, creates a Rawlsian veil of ignorance and, consequently, renders the notion of the median person obsolete.

\(^9\) An alternative construction in an earlier draft relied on results by Judd (1985) and Haller (1984) about a continuum of i.i.d. random variables, and led to a model where reservation levels are i.i.d. across individuals. That model represents the case where group members are perfectly identical ex ante—apart from their names—while they are diverse ex post.
that individuals (names, addresses) are uniformly distributed on \( I = J = [t_B, t_U] \) with cumulative distribution function \( F \). Solely for descriptive convenience, assume further that \( t_B = 0 \) and \( t_U = T \). Fix a cumulative distribution function \( G_0 \) for the reservation utility of voter \( i = 0, t_0 \), with mean \( \tilde{t}_0 \). Set \( \Omega = S \times J \), let the \( \omega \)'s be distributed according to \( H \times G_0 \), and define \( \sigma(\omega) = s \), \( t_0(\omega) = \tau(\omega, 0) = t \) for \( \omega = (s, t) \in \Omega \). Given the reservation utility of voter \( i = 0, t_0 \), let the reservation level \( t_i \) of an arbitrary group member \( i \in I \) be given by \( t_i = t_0 + i \mod T \), that is,

\[
\begin{align*}
    t_i &= t_0 + i, & \text{if } t_0 + i < T \\
    t_i &= t_0 + i - T, & \text{if } t_0 + i \geq T.
\end{align*}
\]

This gives a probabilistic model in which voters do not know, but have related priors over, their reservation utilities. Now \( t_i \) has mean

\[
\begin{align*}
    \tilde{t}_i &= \int_{x \leq T-i} \left( x + i \right) G_0(dx) + \int_{x > T-i} \left( x - (T - i) \right) G_0(dx) \\
    &= \tilde{t}_0 + i + T \cdot G_0(T - i) - T.
\end{align*}
\]

We observe that \( \tilde{t}_i = \tilde{t}_0 \) for all \( i \) if and only if \( G_0(T - i) = 1 - i/T \) for all \( i \), that is, \( t_0 \) is uniformly distributed. To conclude, the hypothesis of Proposition 7 can be met, if \( G_0 \) is uniformly distributed and \( t_i = t_0 + i \mod T \). Then the family of random variables \( (t_i)_{i \in I} \) is identically, but not independently, distributed. The correlation between any two \( t_i, t_k \) with \( i \neq k \) is nonzero and nonlinear.

To analyse the general case of a constitutional ratification requirement seems very difficult, if not impossible. The main technical obstacle is that in general, the empirical distribution of reservation levels varies with the state of the world. Consequently, a ratification requirement \( f^* \) results in state-dependent critical values \( t^* \), which make it hard to track the overall effect of a particular ratification requirement. Our alternative construction, above, rules out such a complication and can handle specific cases beyond that of Proposition 7. For example, let \( G_0 \) put point mass \( 1/2 \) on both \( 0 \) and \( T/2 \). Then for \( 0 \leq i < T/2 \), \( \tilde{t}_i = i + T/4 \) and for \( T/2 \leq i < T \), \( \tilde{t}_i = i - T/4 \). Hence \( \tilde{t} \) has uniform distribution \( \tilde{F} \) on the interval \( [1/2, 1/2 + T/4] \), while in each state of the world, \( F \), the empirical distribution of reservation levels, is uniform on \([0, T]\). For this example, the analogue of Proposition 1 holds, except that now \( t' = T/2 \) stands for the median of \( \tilde{F} \).

The above analysis could be extended to the case of two groups, though the analysis would be more complicated. We remark on a likely consequence of such an exercise. When deciding on ratification requirements in the Constitution for a country or an organisation, it will be clear that the requirement will apply to many different future negotiations. The choice of ratification requirement will then reflect whether the median voter expects to be more or less interested in obtaining an agreement than his various counterparts. If a median voter expects in general to be the stronger part, in the sense of having the higher reservation utility, it follows from an analogue to Proposition 7 that it will be beneficial to have a strict ratification
requirement. (One cannot avoid thinking about the rather strict ratification requirements for international treaties specified in the U.S. Constitution.) Conversely, if a median voter expects in general to be the weaker part, a 50 percent majority requirement is the natural choice.

5. DISCUSSION

Our basic modelling approach assumes that a) the group is represented by a single agent, and b) the group may want to use a ratification requirement as an instrument to influence the bargaining outcome. As a practical matter, large groups are represented by agents in the bargaining. Our assumption that there is only one negotiator rules out certain intriguing strategic possibilities, that, however, are not the focus of our investigation. The question we want to address in the first part of this section is whether the group may use other instruments to influence the bargaining that are superior to a ratification requirement. We shall argue that a ratification requirement is a preferable means of commitment in many instances, but we do not claim that it is superior to other instruments under all circumstances. We concentrate on conceivable alternative measures decided upon ex ante, before $s$ is known. Specifically, we are going to discuss two alternatives/complements to a ratification requirement:

(i) commitment without ratification requirement
(ii) agent compensation scheme

Let us first consider other aspects of a ratification requirement than those that are the focus of our formal model. A crucial assumption in using a ratification requirement as a means of commitment is clearly that the group is heterogeneous. If the group consists of homogeneous individuals, all votes will be unanimous (unless all individuals are indifferent), and the strictness of a ratification requirement is without importance. But requiring heterogeneity seems a very weak assumption in real world settings; one would always expect some heterogeneity within a large group. (As illustrated by Proposition 7 above, individuals may well be identical ex ante, as long as they are heterogeneous when the ratification is to take place.)

As mentioned in the Introduction, a ratification requirement may have additional benefits, for example, ensuring democratic control, influencing the group members' acceptance of the agreement, and helping in aggregating information. There are, however, costs associated with having a ratification requirement. The voting that is required may be costly and time consuming. Group members must spend time gathering information about the agreement. Beneficial agreements may be rejected due to ignorance among group members. The risk that a negotiated agreement is rejected may deter the other party from entering the negotiations at all.\textsuperscript{10}

\textsuperscript{10} In a previous version of the paper we explicitly allowed for costs of a ratification requirement, representing the costs of voting, etc. But such costs do not change our qualitative conclusions: essentially their only effect is that the group does not set a ratification requirement if the costs are greater than the gain from the requirement.
A possible problem with ratification requirement is side payments within the group, which could undermine the credibility of nonratification as a bargaining threat. If a bargaining outcome is reached that is beneficial to a majority of the group, but the majority falls short of the required super-majority, then this majority might bribe some of the minority to vote for the agreement. If such an attempt succeeds, then the adopted ratification requirement, de facto, does not constitute a credible commitment.

However, feasibility of side payments depends on specific conditions, especially the information structure. Most importantly, if the types of group members are not publicly known, then individuals have an incentive to misreport or deny their type to manipulate the flow of side payments. This may be one of the reasons why in the political arena losing minorities are frequently not compensated. (As an aside: this outcome would be reinforced by the fact that for political minorities, secession is often not an option.) Furthermore, the beneficiaries of an agreement might lack the monetary funds to compensate others fully. In the sequel, we shall neglect the possibility of side payments.

**Commitment Without a Ratification Requirement.** In terms of its effect on the bargaining outcome, a ratification requirement amounts to reducing the feasible set by imposing the restriction $\alpha \geq t^*$. Prima facie, it appears to be much simpler to abandon the ratification procedure and pass a law or statute obliging group leaders to only sign agreements that satisfy $\alpha \geq t^*$. Or even better, let the requirement be an increasing function of the available surplus, $t^*(s)$. This would make it possible to obtain a large share of a large cake, without preventing an agreement when the surplus is small. However, in many real-life situations schemes like this may not have the same commitment function as a ratification requirement.

First, many negotiations deal with highly complex issues, where important details in possible agreements are difficult to foresee. Thus it may be problematic to write down a law or statute that specifies a minimum requirement of the agreement.

Secondly, in some situations commitment through laws or statutes may be less credible than commitment via a ratification requirement. One reason for this is that a law or statute can normally be changed by a simple majority. Consider an agreement which is beneficial to the median voter, yet it does not meet the requirement provided in the law, $t' < \alpha < t^*$. Now there exists a majority of group members who would want to change the law, so that the negotiated agreement could be signed. However, this possibility makes the initial commitment incredible. Thus, it is not clear that such a law will have any effect on the bargaining outcome. A ratification requirement is subject to similar criticism. A majority of the voters may well regret that an agreement that satisfies $\alpha > t'$ is not signed and be tempted to have the ratification requirement waived. But even in cases where this is legally possible, they may hesitate to do so for the sake of internal group stability. After all, by deciding upon a super-majority ratification requirement, they have granted veto power to a minority who might resent losing the privilege.

Thirdly, if the agreement is so complex that it is not verifiable that $t' < \alpha < t^*$ holds, the majority of the group members need not even change the law. They might wrongly, yet irrefutably claim that the agreement’s worth to the group is $w \geq t^*$. 
Hence, they might prevail. If such circumstances are conceivable, the commitment is in jeopardy. A ratification requirement is immune against such a plot.

A recent example may illustrate these arguments. When Norway agreed to participate in the European Economic Area (EEA), many Norwegian laws had to be changed because they ran contrary to the consequences of Norway's membership of the EEA. If the Norwegian Storting (i.e., the parliament) were to have added another law before the negotiations saying that certain requirements must be met if Norway were to participate in the EEA, this might of course have had a political effect, but the commitment value would be zero; it would just be another law to be changed when joining the EEA. However, the ratification requirement of a three-quarter majority in the Storting that applied to this decision could not be nullified so easily.\textsuperscript{11}

\textit{Agent Compensation Scheme.} An alternative way to improve one's own bargaining position is to be represented in the bargaining by an agent with an appropriate utility function (Schelling 1960; Sklivas 1987, Fershtman, Judd and Kalai 1991). This can be implemented by the choice of agent (which we analysed in a previous version of the paper), or by designing a specific compensation scheme of the agent. In this subsection we show that by designing a compensation scheme that makes the agent very aggressive during bargaining, the group may appropriate essentially all the surplus in the negotiation. This can be achieved by exploiting the well-known feature of Nash bargaining that it is advantageous to be risk seeking (and disadvantageous to be risk averse, Bacharach 1976). We also discuss some of the practical limitations to what can be achieved by the choice of compensation scheme.

To illustrate the idea, consider the following compensation scheme, where the agent receives a compensation \( v \) given by

\begin{equation}
\begin{align*}
v &= k \alpha^b, & \text{if } \alpha \geq t' \quad (\text{where } k, b > 0), \\
v &= 0 & \text{otherwise}.
\end{align*}
\end{equation}

The bargaining is conducted between this agent and player 2, and both disagreement points are set to zero. The Nash bargaining solution is

\begin{equation}
\alpha = \arg \max_{\alpha \geq t'} k \alpha^b (s - \alpha)
\end{equation}

which solves for \( \alpha^* = bs/(b + 1) \), provided that \( \alpha^* \geq t' \). Note that \( \alpha^* \) approaches \( s \) as \( b \) converges to infinity. Thus, by choosing a sufficiently large \( b \), the group may obtain essentially the entire surplus from bargaining. Moreover, by choosing a sufficiently small \( k \), the compensation to the agent will still be negligible. However, an optimal scheme does not exist, as it will always be better to reduce \( k \) further.

This solution, that the group sets a high \( b \) and a low \( k \) and thus obtains essentially the entire surplus, does not necessarily make ratification requirements

\textsuperscript{11}As a contrast: in other situations where the government has been given the power to sign an agreement without parliamentary approval afterwards, a law that stipulated minimum requirements would have an effect upon the outcome, as the government could not just change the law.
redundant as a means of commitment. Clearly, player 2 may also hire an agent, and provide him/her with a similar compensation scheme, with parameters $q$ and $d$. In this situation, the bargaining outcome is given by

$$
\alpha = \arg \max_{\alpha \geq r'} k \alpha^b q(s - \alpha)^d
$$

that solves for $\alpha^* = bs/(b + d)$ (as long as $\alpha^* \geq r'$). Thus, as long as $b = d$, we have $\alpha^* = s/2$, regardless of the value of $b$. The striking result is that if both parties choose compensation schemes for their agents of the type given in (10) to improve their bargaining positions, with the same parameters, the effects cancel out, and the situation is equivalent to the case where both agents have a linear utility function, as assumed in our basic model. The potential gain from using a ratification requirement prevails. (With other types of compensation schemes, this property may not hold.)

In addition, there are practical problems with implementing a good compensation scheme. For instance, one would have to give the agent a nonnegligible compensation to ensure a sufficient incentive for the agent, which sets a limit to how small $k$ may be. Perhaps more importantly, the use of a specific agent compensation scheme is also subject to problems of lack of credibility similar to those discussed above. If the other party refuses to negotiate with an aggressive agent, the group will have an incentive to replace him/her. If the negotiations involve many complex issues, additional problems of incomplete contracting arise. Ahead of the actual negotiations, lack of knowledge of important details of the possible outcomes makes it difficult to design a satisfactory compensation scheme. Moreover, for the compensation scheme to be legally binding, $\alpha$ must be verifiable, which again is problematic if $\alpha$ depends on the evaluation of many issues.

*Practice.* Ratification requirements are a widespread institutional arrangement. Lahne (1968) reports that 29 out of the 73 U.S. national union contracts examined required contract ratification at some level; in addition, ratification may be required in regional and local statutes, or by convention. In Europe, ratification requirements for collective bargaining agreements differ across countries, and some union constitutions allow for the interpretation that ratification is optional. Our informal talks with management negotiators indicate that a union ratification requirement may indeed improve the bargaining position of the union, as argued in the present paper.

The ratification requirement in the union constitutions appears to be almost always 50 percent. Thus, we do not find the super-majority requirement that the model in Section 2 might suggest. Rather, the 50 percent majority is probably better explained as a defense against a disadvantageous agreement (c.f. the discussion of Proposition 5 above). One should bear in mind the difference between our model, where a rejection of an agreement is final, and a collective bargaining situation, where a rejection may entail a strike. Unless a strike commands support of a majority of the workers, it seems unlikely that the workers would prevail, in particular when the low support of the strike is known to the management.
Agreements between countries constitute the other main area of ratification requirements. There appears to be a large variety of decision and voting procedures in different countries, and there exist also different procedures in each country depending on the type of decision. Important agreements, for instance membership in the European Union (EU), may require a change in the Constitution. Hylland (1994) gives examples from several European countries and the U.S. of requirements to change the Constitution. A simple majority in a single vote in the parliament is never sufficient. Examples of requirements are: simple majority in two votes in the parliament, with an election to parliament in between (Sweden), two thirds majority in two chambers in the Congress and ratification by a three-quarter majority of the individual states (the U.S.), simple majority in two votes in parliament, election between votes, and then a popular referendum (Denmark). As an example of the benefits of a ratification requirement: After the first negative referendum on the Maastricht treaty in Denmark, Denmark was allowed to keep the choice of whether it would participate in stage three.

Sometimes the procedure is a matter of government choice. The Austrian Constitution says that significant changes to the Constitution are to be subject to a popular referendum. However, the term ‘significant’ is left to political interpretation. For instance, the association treaty with the EU was not subject to ratification, whereas the membership treaty with the EU was. The pending referendum most probably helped Austria obtain concessions in sensitive areas (transit rights, agricultural protection) from the EU.

6. CONCLUDING REMARKS

A ratification requirement may give a strategic advantage, as it provides a credible commitment to accept only a very favourable agreement. However, it also involves a risk that no such favourable agreement is feasible and consequently no agreement is reached, even in situations where mutually beneficial agreements were possible. When deciding whether to have a ratification requirement (and on the size of the required majority), the parties weigh these effects against each other.

If only one of the parties can impose a ratification requirement, we show that under very weak assumptions, the median voter of this party will want a required majority above 50 percent in order to obtain a larger share of the pie. However, in the general case we cannot be certain that the median voter will prevail. With more specific assumptions, in particular that the surplus from an agreement is uniformly distributed, we show that the unique optimal super-majority requirement of the median voter will indeed be chosen by the group. The associated critical value $r^*$ (i.e., the minimal acceptable agreement) is increasing in the reservation value of the median voter, which corresponds to the intuition that higher reservation utility makes a person more aggressive. On the other hand, the more heterogeneous the group is, the lower a majority will be required (otherwise a rejection of a beneficial agreement would be too likely).

A super-majority requirement will involve an inefficiency, in the sense that the sum of the ex ante expected payoffs of the parties is not maximized. This inefficiency results from the possibility that the required majority is so high that it
precludes mutually beneficial agreements. As one party chooses to set (and benefits from setting) a ratification requirement, the inefficiency is borne entirely by the other party.

In Section 3 we analyse the case where both parties may impose a ratification requirement, and these results have several important implications. First, a ratification requirement magnifies asymmetries, because it is a more potent measure for the stronger part. Small differences lead the stronger group to take a more aggressive position, with possibly stark effects on the outcome. Secondly, ratification requirements have opposing effects on the payoff of the median voter (risk of preventing advantageous agreements versus gain in bargaining power). This involves considerable instability in the outcome of negotiations, and payoffs are not continuous functions of parameter values. Even when the parties are symmetrical, there exist asymmetric equilibria, which is in contrast to standard bargaining theory.

An implication of our analysis is that heterogeneity within a group may be an advantage in negotiations. If the group consists of identical individuals, a ratification requirement exceeding 50 percent would be to no avail—the improvement of bargaining power arising from a ratification requirement presumes that a minority of the group will reject an agreement that the median voter would accept.

Section 4 illustrates how the basic model in the paper encompasses, after suitable modification, the matter of a constitutional ratification requirement, applying to many conceivable future negotiations. Here we show that under very weak assumptions the group will unanimously set a super-majority requirement. Under the assumption that the available surplus is uniformly distributed, we obtain essentially the same results as in the one-negotiation case in Section 2. Among other things, the associated critical value will be an increasing function of the reservation utility of the voters; intuitively, a ‘stronger’ country will set a stricter ratification requirement than a weaker one.

The empirical fact that ratification requirements in a country’s constitution are likely to be enduring raises intriguing issues in light of our analysis, which suggests that optimal requirements may be unstable functions of the underlying parameters. Consider a situation where two countries have regular interaction with each other. Historically, one country has been the stronger (for example, economically), and in line with our analysis this country also has stricter ratification requirements, which magnifies the difference in power between the countries. Then for some reason the balance of power changes, and the other country becomes the stronger. In a one-shot equilibrium, the strictness of ratification requirements should also be reversed. In practice, however, one would expect the country that used to be stronger to be very reluctant to adjust its ratification requirements downwards. One could easily imagine a situation where both countries have strict requirements, and conflicts (like trade wars) arise.

APPENDIX

PROOF OF PROPOSITION 1. Let \( t^*(t) \) be the critical value that maximises the expected utility of an individual with reservation level \( t \). (Later we consider the
question of whether there will be such a value.)

\[ (A1) \quad t^*(t) = \arg \max_{t^*} E_s[u(t, t^*)] \]

\[ = \arg \max_{t^*} \left\{ E[\alpha(\cdot) | \alpha(s, t^*) \geq t^*] + (1 - P(\alpha(s, t^*) \geq t^*)) \right\}. \]

For \( t^* \geq 1 \), the expected utility of voter \( t \) is

\[ (A2) \quad E[u(t, 1)] = t. \]

For \( 1/2 \leq t^* < 1 \), the expected utility is

\[ (A3) \quad E[u(t, t^*)] = t^* \int_1^{t^*} ds + t \int_0^{t^*} ds = t^* + t - (t^*)^2, \]

which is a strictly concave function in \( t^* \). For \( 0 \leq t^* \leq 1/2 \), the expected utility is

\[ (A4) \quad E[u(t, t^*)] = \frac{1}{2} \int_{2t^*}^{1} s ds + t^* \int_{t^*}^{2t^*} ds + t \int_0^{t^*} ds = \frac{1}{4} + tt^*. \]

For \( t^* \leq 0 \),

\[ (A5) \quad E[u(t, t^*)] = \frac{1}{2} \int_0^{1} s ds = \frac{1}{4}. \]

For any \( t \), the partial derivatives of (A3) and (A4) with respect to \( t^* \) coincide at \( t^* = \frac{1}{2} \). Hence the expected utility is a quasi-concave function of \( t^* \). Therefore, for \( t < 0 \), \( E[u(t, t^*)] \) is maximized at all \( t^* \in [t_B, 0] \). For \( t = 0 \), any \( t^* \in [t_B, \frac{1}{2}] \) is optimal. For \( 0 < t < 1 \), the optimal solution is

\[ (A6) \quad t^*(t) = (t + 1)/2, \]

with resulting utility \( E[u(t, (t + 1)/2)] = (t + 1)^2/4. \) We have established the following

**FACT.**

(i) for \( t > 0 \), \( E[u(t, t^*)] \) is singlepeaked in \( t^* \) and the location of the peak, \( t^*(t) \) is monotone in \( t \) with \( \lim_{t \to 0} t^*(t) = \frac{1}{2} \);

(ii) for \( t = 0 \), \( E[u(t, t^*)] \) is constant up to \( t^* = \frac{1}{2} \) and declining thereafter;

(iii) for \( t < 0 \), \( E[u(t, t^*)] \) is constant up to \( t^* = 0 \) and declining thereafter.

As \( t^* \) is determined by simple majority voting and the above fact prevails, a chosen critical value maximizes the expected utility of the median voter: "The median voter decides." \(^{12}\) Consequently, in case \( t' \leq 0 \), the overall solution is always no ratification

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\(^{12}\) This follows from a straightforward extension of the argument in Black's (1958) classic. For further references, see Miller (1987).
requirement—or no binding ratification requirement. For \( t' = 0 \), also \( f^* \leq F(1/2) \) can occur. For \( 0 < t' < 1 \), the optimal critical value is given by (A6). Hence, if the group chooses to have a required ratifying majority, it will be \( f^* = F(t^*) = (t^* - t_B)/T \) where \( t^* = t^*(t') = (t' + 1)/2 \in (t_B, t_U) \). Thus, we have \( f^* = ((t' + 1)/2 - t_B)/T = (t' + 1 - 2t_B)/(2T) = 1/2 + (1 - t')/(2T) \). Q.E.D.

**Proof of Proposition 3.** For any \( t \), define \( \theta(t) \) as the smallest \( t^* \) that maximizes \( E[u(t, t^*)] \). For the time being, we proceed under the assumption that \( t_U \leq 1 \). From (5) follows \( dE[u(t, t^*)]/dt^* > 0 \) for \( 0 < t^* \leq t < 1 \) which demonstrates \( \theta(t) > t \) for all \( t \in (0, 1) \). In particular, \( 2\theta(t) > 2t > 1 \) for all \( t > 1/2 \).

For any \( t \in [t_B, t_U] \) and \( 1 \geq t^* > 1/2 \), define
\[
\varphi(t, t^*) = dE[u(t, t^*)]/dt^* = (t - t^*)h(t^*) + H(2t^*) - H(t^*) = (t - t^*)h(t^*) + 1 - H(t^*).
\]

For each \( t \in (1/2, 1) \),
- either \( \theta(t) < 1 \) and \( \varphi(t, \theta(t)) = 0 \)
- or \( \theta(t) = 1 \) and \( \varphi(t, \theta(t)) \geq 0 \).

We can rule out the second alternative, since \( h(1) > 0 \) so that \( t < 1 \) and \( \theta(t) = 1 \) would yield \( \varphi(t, \theta(t)) = (t - 1)h(1) > 0 \). Thus \( \theta(t) \in (1/2, 1) \) and \( \varphi(t, \theta(t)) = 0 \) for all \( t \in (1/2, 1) \). Moreover, if \( t \in (1/2, 1) \), then it follows from \( h > 0 \) and \( h' \geq 0 \) that
\[
dE[u(t, t^*)]/dt^* > 0 \quad \text{for} \quad 0 < t^* < \theta(t) \quad \text{and}
\]
\[
dE[u(t, t^*)]/dt^* < 0 \quad \text{for} \quad \theta(t) < t^* < 1.
\]

Namely, we can sign \( dE[u(t, t^*)]/dt^* \) unambiguously for \( 0 < t^* \leq t \) and for \( \theta(t) < t^* < 1 \). The rest of the assertion follows from the fact that \( \partial \omega/\partial t^* \neq 0 \) for \( 1/2 < t^* < 1 \), which we show in the sequel.

Hence, those individuals \( t \in (1/2, 1) \) exhibit single-peaked preferences, peaking at \( r^*(t) = \theta(t) \), with respect to the critical value \( t^* \). Next we want to investigate how, within this subpopulation, \( \theta(t) \) responds to a change in \( t \).

We commence by deriving that \( \partial \varphi/\partial t^* = (t - t^*)h'(t^*) - 2h(t^*) \neq 0 \) for all \( (t, t^*) \) with \( 1 > t^* > t > 1/2 \). Namely, \( \partial \varphi/\partial t^* = 0 \) would imply \( h'(t^*) = -2h(t^*)/(t^* - t) < 0 \), contradicting the hypothesis \( h' \geq 0 \). Hence the system of first-order conditions \( \varphi(t, \theta(t)) = 0 \) implicitly defines the function \( \theta(t) \) and \( \theta(t) \) is differentiable with
\[
\frac{d\theta(t)}{dt} = -\frac{\partial \varphi}{\partial t}(t, \theta(t)) \quad \frac{\partial \varphi}{\partial t^*}(t, \theta(t))
\]
\[
= h(\theta(t)) \quad (\theta(t) - t)h'(\theta(t)) + 2h(\theta(t))
\]
which implies \( 0 < d\theta(t)/dt < 1/2 \).
Now consider any $t^{**} < \theta(t')$. Since $t' > 1/2$ and, furthermore, $\theta(t)$ is continuous and strictly increasing in $t > 1/2$, we can pick a $t^0 \in (1/2, t')$ with $\theta(t') > \theta(t^0) > t^{**}$. Put $\theta^{**} = \theta(t^0)$. Then each group member $t$ with $t \geq t^0$ prefers the critical value $\theta^{**}$ to $t^{**}$, since for all such $t$, $E[u(t, t^*)]$ is strictly increasing in $t^* \leq \theta(t)$ and $t^{**} < \theta^{**} = \theta(t^0) \leq \theta(t)$. Therefore, more than 50% of group members prefer $\theta^{**}$ to $t^{**}$. Thus $t^{**}$ is defeatable.

Next consider any $t > t^{**} > \theta(t')$. Then $t^{**} > \theta(t') > t' > 1/2$ and $\varphi(t', t^{**}) < 0$. By continuity, there exist $t^1 > t'$ and $\theta^{**}$ with $1/2 < \theta^{**} < t^{**}$ such that $\varphi(t^1, t^{**}) < 0$ for all $t^* \in [\theta^{**}, t^{**}]$. But then, because of $h \geq 0$, $\varphi(t, t^*) < 0$ for all $t \leq t^1$ and $t^* \in [\theta^{**}, t^{**}]$. Hence all $t \leq t^1$ prefer $\theta^{**}$ to $t^{**}$. Therefore, more than 50% of group members prefer $\theta^{**}$ to $t^{**}$. Thus $t^{**}$ is defeatable.

Finally, suppose $\theta(t') = t^*(t')$ is put against another proposal $t^{**}$. If $t^{**} < \theta(t')$, then all $t \geq t'$ and, hence, at least 50% of group members prefer $\theta(t')$ to $t^{**}$. Consequently, $\theta(t')$ cannot be defeated by $t^{**}$. If $t^{**} > \theta(t')$, then recall that $\varphi(t', \theta(t')) = 0$ and $\varphi(t', t^*) < 0$ for $1 > t^* > \theta(t')$. Hence for all $t < t'$ and $1 > t^* \geq \theta(t')$, $\varphi(t, t^*) < 0$. Therefore, all $t \leq t'$ and, consequently, at least 50% of group members prefer $\theta(t')$ to $t^{**}$. This shows that $\theta(t')$ cannot be defeated by $t^{**}$.

It remains to deal with the case $t^U > 1$. As an immediate consequence of the analogue of (5), we obtain $dE[u(t, t^*)]/dt^* < 0$ for $t > 1$ and $0 < t^* < 1$. Moreover, $\theta(t) = 1$ for $t > 1$. It follows from these properties that the existence of a nonnegligible set of group members with excessive reservation utilities $t > 1$ does not affect our previous conclusions.

Q.E.D.

**Proof of Proposition 5.** Assume that $r^* = r'$, and consider the best response, that is, the optimal $t^*$. We distinguish four intervals for the critical value $t^*$. (We observe that the following expressions for $E[u]$ exhibit quasi-concavity with respect to $t^*$ and enough 'monotonicity of peaks' to support the median voter paradigm.)

**Interval 1.** $t^* < r^* = r' = t'$. In this case the expected utility of the median voter is

\begin{equation}
(A7) \quad E[u] = t' \int_0^{t^* + r^*} ds + \int_{t^* + r^*}^{2r^*} (s-r^*) \, ds + \frac{1}{2} \int_{2r^*}^{1} s \, ds,
\end{equation}

which can be evaluated to yield

\begin{equation}
(A8) \quad E[u] = t' (t^* + r^*) + \left[ \frac{1}{2} s^2 - sr^* \right]_{t^* + r^*}^{2r^*} + \frac{1}{4} [s^2]_{2r^*}^1
\end{equation}

\[= t' (t^* + r^*) - \frac{(r^*)^2}{2} - \frac{(t^*)^2}{2} + \frac{1}{4}. \]

To look for an interior solution $t^*$, we differentiate (A8) with respect to $t^*$, and obtain

\begin{equation}
(A9) \quad \partial E[u] / \partial t^* = t' - t^* > 0, \quad \text{for all } t^* < t'.
\end{equation}

Thus, the optimal $t^*$ cannot be less than $r^* = t'$. 

\textbf{Interval 2.} \( r^* \leq t^* < 1/2 \). In this case the expected utility of the median voter is

\begin{equation}
E[u] = t' \int_0^{t^*+r^*} ds + t^* \int_{t^*+r^*}^{2t^*} ds + \frac{1}{2} \int_{2t^*}^1 s \, ds.
\end{equation}

(A10) can be reduced to

\begin{equation}
E[u] = t' (t^* + r^*) + t^* (t^* - r^*) + \frac{1}{4} \left[ s^2 \right]_{2t^*}^{t^*}.
\end{equation}

(A11)

\begin{align*}
&= t' (t^* + r^*) - t^* r^* + \frac{1}{4}.
\end{align*}

Differentiating (A11) with respect to \( t^* \) yields

\begin{equation}
\frac{\partial E[u]}{\partial t^*} = t' - r^* = 0.
\end{equation}

(A12)

Thus, all \( t^* \in [r^*, 1/2] \) give the same expected payoff, namely

\begin{equation}
E[u(s,t',r^*)] = (t')^2 + 1/4.
\end{equation}

\textbf{Interval 3.} \( 1/2 \leq t^* \leq 1 - r^* \). In this case the expected utility of the median voter is

\begin{equation}
E[u] = t' \int_0^{t^*+r^*} ds + t^* \int_{t^*+r^*}^{1} ds.
\end{equation}

(A14) can be reduced to

\begin{equation}
E[u] = t' (t^* + r^*) + t^* (1 - t^* - r^*).
\end{equation}

(A15)

Differentiating (A15) with respect to \( t^* \) yields

\begin{equation}
\frac{\partial E[u]}{\partial t^*} = t' + 1 - r^* - 2t^* < 0, \quad \text{for all } t^* \in (1/2, 1 - r^*],
\end{equation}

(A16)

so there is no interior solution in this interval.

\textbf{Interval 4.}

\( t^* > 1 - r^* \). Incompatible demands: \( E[u] = t' \).

Thus, \( t^* \in [t', 1/2] \) is the best reply to \( r^* = r' \).

Then consider the optimal choice of \( t^* \) given that \( r^* \in (r', 1/2) \). Going through the four intervals above, it is clear that the unique best reply is in interval 1, \( t^* = t' \).

We then proceed to show that there cannot be another nontrivial equilibrium. Part A completes the determination of best responses. Part B applies these findings to rule out other equilibria.
Part A. First, consider \( r^* \in (1/2, 1 - t') \). Then the analysis is the same as in the case \( r^* \in (r', 1/2) \), so that \( t^* = t' \) is the best reply. Secondly, against \( r^* = 1 - t' \), \( t^* \in [t', 1] \) is the best response. Thirdly, against \( r^* \in (1 - t', 1] \), \( t^* \in (1 - r^*, 1] \subset [t', 1] \) is the best response. Fourthly, assume \( r^* < r' \). Then the best reply lies in interval 4 and is \( t^* = (1 + r' - r^*)/2 \in (1/2, 1) \).

Part B. First, let \( r^* < r' \) and \( t^* = (1 + r' - r^*)/2 \in (1/2, 1) \) be the best response against \( r^* \). Now suppose \( t^* < 1 - t' \). Then \( r^* = r' \) is the best response against \( t^* \). Next suppose \( t^* = 1 - t' \). Then any best reply against \( t^* \) satisfies \( r^* \geq t' = r' \). Lastly suppose \( t^* > 1 - t' \). Then each best reply \( r^* \) against \( t^* \) satisfies \( r^* > t' = r' \). In the last case, equilibrium would then require that \( r^* > 1 - (1 + r' - r^*)/2 \) or \( r^* > 1 - r' \), contradicting \( r^* < r' \). Hence in any case, \( r^* < r' \) cannot be a part of an equilibrium. Obviously, \( r^* \in (1/2, 1 - t') \) cannot be a part of an equilibrium because the best reply to an \( r^* \) in this interval is \( t^* = t' \), and \( r^* \in (1/2, 1 - t') \) is not the best reply to \( t^* = t' \). Finally, \( r^* \in [1 - t', 1] \) can only be a part of a trivial equilibrium.

Q.E.D.

Proof of Proposition 6. Let \( r^* = r' \) and consider the choice of \( t^* \). As above, we start off from \( t^* = 0 \), and consider the effect on expected utility of varying \( t^* \). The analysis of the various intervals in the proof of Proposition 5 above shows that expected utility is strictly increasing until \( t^* = (t' + 1 - r^*)/2 \) (in interval 3), and strictly decreasing for all values of \( t^* \in ((t' + 1 - r^*)/2, 1 - r^*) \) (cf. (A9), (A12) and (A16)), while putting \( t^* = 1 - r^* \) in (A15) yields \( t' \). Thus, the optimal choice is \( t^* = (t' + 1 - r^*)/2 \in (1/2, 1 - r^*) \).

Then let \( r^* = (t' + 1 - r^*)/2 \) and consider the choice of \( r^* \). Going through the intervals starting off from \( r^* = 0 \), we find that the optimal \( r^* \) is \( r^* = r' \) (cf. analogues of (A9), (A12), (A16)).

We then show that there can be no other equilibria. Assume first that \( r^* < r' \). Going through the analysis above shows that \( t^* = (t' + 1 - r^*)/2 \) is still the best reply. But as \( r^* = r' \) is the best reply to \( t^* = (t' + 1 - r^*)/2 \), \( r^* < r' \) cannot be an equilibrium value. Then assume that \( r^* > r' \). From the analysis of interval 1 above, we see that \( t^* \) is at least equal to \( t' \). However, when \( t^* \geq t' \), going through the intervals above shows that \( r^* = r' \), so that \( r^* > r' \) cannot be an equilibrium value.

Q.E.D.

Proof of Proposition 7. Ex post, the bargaining situation with respect to a specific treaty is determined by the realised state of nature \( \omega \in \Omega \): the surplus to be shared is \( s = \sigma(\omega) \); for generic group member \( i \), the reservation level is \( t_i = \tau(\omega, i) \); Suppose a critical value \( t^* \) is in place. Then group member \( i \) obtains utility \( u(t_i, t^*) = u(t_i, t^*, s) \) as given by (2). (a) By the same procedure as in the Proof of Proposition 1, we find that, given a realised reservation level \( t_i \) for group member \( i \), the group member has conditional expected utilities

\[
E_s[u(t_i, 1)] = t_i \quad \text{for } t^* = 1;
\]

\[
E_s[u(t_i, t^*)] = t_it^* + t^* - (t^*)^2 \quad \text{for } 1/2 \leq t^* < 1;
\]

\[
E_s[u(t_i, t^*)] = 1/4 + t_it^* \quad \text{for } t^* \leq 1/2.
\]
Ex ante, a critical value $t^*$ yields expected utility

$$E_{\omega}u = \hat{t}$$

for $t^* = 1$,

$$E_{\omega}u = \hat{t}t^* + t^* - (t^*)^2$$

for $1/2 \leq t^* < 1$,

$$E_{\omega}u = 1/4 + \hat{t}t^*$$

for $t^* \leq 1/2$,

for every $i \in I$. Hence, the ex ante expected utilities assume the same functional form as in Section 2. Therefore, since all group members are identical ex ante, each of them has the same favourite (ex ante) critical value $t^* = (\hat{t} + 1)/2$, if there should be a ratification requirement.

(b) The analogue of (4) yields

$$E_i[u(t_i, t^*)] = t_i H(t^*) + t^*[H(2t^*) - H(t^*)] + E[s/2|s > 2t^*](1 - H(2t^*)),$$

with the last term vanishing if $2t^{**} > 1$. Hence, $E_i[u(t_i, t^*)]$ is linear in $t_i$. Therefore, ex ante a critical value $t^*$ yields expected utility

$$E_{\omega}u = \hat{t}H(t^*) + t^*[H(2t^*) - H(t^*)] + E[s/2|s > 2t^*](1 - H(2t^*))$$

It follows that

$$dE_{\omega}u/dt^* = (\hat{t} - t^*)h(t^*) + H(2t^*) - H(t^*).$$

Hence, for $0 < t^* \leq \hat{t} < 1$, $dE_{\omega}u/dt^* > 0$. Let $\theta^*$ be the smallest $t^*$ that maximises $E_{\omega}u$. Then $\hat{t} < \theta^* \leq 1$ and $f^* = F(\theta^*) > 1/2$ will do. Q.E.D.

REFERENCES


RATIFICATION REQUIREMENTS


