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Bargaining, Distribution and Efficiency in Norwegian Moose Hunting

ODD GASDAL (odd.gasdal@sos.uib.no)

Department of Sociology, University of Bergen, Norway

Abstract

Efficient utilization of common pool resources requires that users accept a limit on their *aggregate* resource extraction. But it also requires that they accept a *division*, or procedures and rules for the division, of their individual extraction rights. Thus, potential “tragedy of the commons” problems tend to get exacerbated by distributional (or bargaining) problems. Such problems may even persist in cases where the “tragedy” of overuse has been prevented through externally imposed regulation of aggregate extraction quotas. This paper approaches these issues from the perspective of bargaining theory. It discusses what sources of bargaining power there might be and how institutional context and user heterogeneity (i.e. distribution of access to sources of power) may affect the rules and other institutional arrangements that common pool resource users agree to set up to solve distributional conflicts. It also discusses how these institutional arrangements and user heterogeneity together may affect the final distribution and allocative efficiency of common pool resource utilization. The discussion is illustrated with examples from Norwegian moose hunting. We compare areas with varying degrees of hunting right owner heterogeneity and assess how these differences are associated with different kinds of institutional arrangements and distributional outcomes in local commons. We also estimate individual level associations between bargaining power indices and distributional outcomes. The analyses are made using survey data that were gathered from random samples of approximately 1,000 hunting right holding landowners and 1,000 hunters in two Norwegian counties. Three of our most general conclusions concerning the moose hunting case are that: 1. Unequal distributions of hunting input resources (such as land) seem to lead to even more unequal distributions of power and hunting yields. 2. That unequal power distributions may support institutional arrangements that lead to inefficient resource utilization. 3. That these outcomes are dependent on the institutional context and might change if hunting laws or hunting policies change.

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Introduction

Efficient utilization of common pool resources requires that users accept a limit on *aggregate* resource extraction. But they must also accept a division of individual extraction rights. Thus, potential “tragedy of the commons” problems tend to get exacerbated by distributional problems. The distributional problems may persist even in cases where the “tragedy” of overuse is prevented through externally imposed extraction quotas. This paper discusses how institutional context and power relations may affect the institutional arrangements people set up to solve distributional problems. Simultaneously it also discusses how power relations and the chosen institutional arrangements may affect the distribution and efficiency of outcomes. Our arguments will be illustrated with examples taken from a study of Norwegian moose hunting.

Our most general conclusion is that user heterogeneity may affect the distribution of power, which in turn may impact institutional arrangements in ways that have complex implications for outcome distributions and efficiency. In the moose hunting case the main tendencies seem to be that: 1. Equality reinforces equality while inequality preserves inequality. 2. Skewed power distributions may underpin institutional arrangements that lead to inefficient resource utilization.

Problems

Norwegian moose populations are common pool resources. This fact, combined with moose hunting’s popularity as a recreational sport and the high prices paid for moose meat, makes them prone to over-harvesting. I will outline how Norwegian wildlife managers try to solve this problem. But my main topics are the distribution of gains from moose hunting and what Ostrom et al. (1994) call the *assignment problem*, (i.e. the problem that the competition for appropriation positions may lead to unnecessarily high appropriation costs or unnecessarily low exploitation levels). The twist to the moose hunting case is that the physical appropriation process is cooperative. Therefore, the primary issue is not how sites or extraction quotas get distributed. Instead I discuss how the meat yield and the opportunities to join the hunting team get distributed; and I also discuss how the intricacies of this distribution process may affect aggregate costs and gains. Put in the terminology of Ostrom (1999) these are problems of boundary, authority and payoff rule choices. So, to be a little more precise, the problems I intend to discuss are: How do the institutional context and the distribution of resources and abilities among the owners of the resource affect the internal distribution of bargaining power in the commons? What are the effects of heterogeneously distributed bargaining power on the institutions of the commons and the distribution of appropriation positions and yield? And how do these outcomes affect the allocative efficiency of the appropriation process?

Theory

The 2x2 normal form game matrix has become an icon of common pool resource analysis. Thus, it should come as no surprise that big game hunting, too, has been depicted as a 2x2 game (Alvard 2001; Alvard & Nolin 2002).

Sosis (2002), however, criticizes the view that big game hunters' strategy choices are adequately captured by the "either or" of a 2x2 matrix. From times immemorial hunters and fishers have had to agree on the division of efforts and outputs (Hawkes 2001). According to Sosis, Feldstein & Hill (1998) this can be construed as a *bargaining* game. The bargaining aspect of cooperation has been recognized by a series of collective choice theorists (Hardin 1982; Elster 1989; Hackett, Dudley & Walker 1994; Ostrom 1994; Bardhan 2005) but, to my knowledge, relatively few attempts have been made at further theoretical exploration of the issue. Sosis (2002) seems to assume that bargaining theory always predict the Nash bargaining solution (Nash 1950; Nash 1953) as the most likely outcome of bargaining games. To be sure, recent developments in bargaining theory have confirmed that bargaining games may have an approximate Nash solution as their unique equilibrium. (Binmore 1987; Osborne & Rubinstein 1990.) But first, there are a lot of other possible outcomes than Nash's original symmetrical solution, and these outcomes are thought to depend on, among other things, the distribution of various kinds of *power*, which in turn might depend on the rules of the game and individual attributes of the bargaining parties etc. Second, the Nash solution is construed as an efficient solution, and some bargaining theorists, in the spirit of Edgeworth (1881), tend to assume that bargainers actually arrive at allocationally efficient (or Pareto optimal) solutions. That is, to paraphrase Milton Friedman, they expect bargainers not to leave money on the street. But experience tells us that this cannot be taken for granted.

Since the publication of Rubinstein's seminal article (Rubinstein 1982), his two parties, alternating offers model has become the workhorse of non-cooperative bargaining theory. In most cases it predicts a unique and efficient, "subgame perfect" equilibrium solution, and it provides an approximate Nash solution in those cases where people discount future incomes and the time period between offers approaches zero. The Nash solution implies that parties with equal bargaining powers get equal shares of material surplus. Within the confines set by this model a party's bargaining power depends on her discount rate, her bargaining costs, her attitude towards risk, and on whether she is the first bidder or not. If one of the parties discounts future outcomes at a higher rate (is less patient) or has higher bargaining costs than the other, or is more afraid of a sudden breakdown of negotiations than the other, then this party has less bargaining power than the other, and hence, if the time period between offers approaches zero, the model's predicted solution approaches an asymmetrical Nash solution where the less powerful party gets a smaller share of the surplus than the other party. Hart & Mas-Colell (1996) have derived similar results for n-person bargaining models. (But see below.) The Nash solution also holds in several evolutionary bargaining game models where assumptions about actor rationality are thought to be more realistic than in traditional game theory. (Napel 2002; Binmore et al. 2003; Skyrms 2004.)

The Rubinstein model also extends to cases in which the bargaining parties have access to "outside options", which are actions they may pursue as an alternative to reaching a negotiated solution. The model predicts that outside options don't have an impact on the bargaining solution unless one of the bargaining parties finds her best outside option to be better than the ordinary equilibrium solution. In this case the prediction is that this party gets a piece of the cake that is slightly larger than what the outside option would have brought her. (Osborne & Rubinstein 1990.) This result seems to be supported by experimental studies. (Binmore, Shaked & Sutton 1989; Binmore & al. 1998; Camerer 2003.)

So far so good, but in many cases we just have to abandon the original Rubinstein model to get a reasonably good fit with reality. I briefly address four kinds of adaptations that one might make: The introduction of discrete strategy choices; the introduction of multilayered games that include choices of institutional constraints on the rules of subsequent games; the introduction of more than two players; and the introduction of fairness norms.

I opened this section by questioning a one-sided use of matrix game approaches. But I am not advocating the total demise of matrix game models. The Rubinstein bargaining model and its derivatives assume that all disputed goods are continuously divisible. But, evidently, this is not always the case. For instance, people often bargain about the choices of institutional solutions, or about who should have the right to use a particular resource. It is not likely that such discrete alternatives always can be turned into continuously variable alternatives through mixed strategy choices or side payments, and, hence, we may also have to accept that negotiations sometimes are more adequately captured by matrix game models than by conventional bargaining models.

Writers on matrix games seldom discuss bargaining power, or any other kinds of power for that matter. But Steven Brams (1990; 1994) has contributed to the subject in his “theory of moves”. His ideas seem to accord reasonably well with those of Rubinstein: a. He considers a party’s ability to win out in contests and negotiations to depend, not always, but still quite often, on its ability to make new bids and moves and to endure setbacks and deadlocks. This seems to correspond roughly to the importance ascribed to low bargaining costs and “patience” in conventional bargaining theory. b. He finds that it often, just as in the Rubinstein model, pays to be the first mover, but that it also, occasionally, may pay to be able to stay put and wait for the opponent to move. c. He accords with Schelling (1960) in seeing the ability to pose credible threats to hurt others (even when hurting oneself in the same move) as a source of power. d. He sees size as a source of power that might help coalitions to win out in voting games.

Let us now take a closer look at two themes where matrix game theory might be useful: The effects of threats or reputation, and the selection of inefficient institutions.

Matrix game types like “chicken” and “battle of the sexes” depict bargaining situations in which the contestants have antagonistic interests and where no balanced compromises in pure strategies can be reached. Simulations and experiments indicate that participants who discover clearly discernible differences in each other spontaneously interpret these as signals of relative aggressiveness and develop conventions about which kinds of participants that should have precedence and which should give in. (Skyrms 1996; Hargreaves Heap & Varoufakis 2004.) Such conventions get stabilized if parties with compatible strategies are allowed to segregate themselves from other parties. Thus, where people interact locally rather than across local area boundaries, stable local conventions may develop. All sorts of traits can be selected as differentiation criteria. Still it seems likely that traits that signal more tangible power, such as sex (male muscular strength) or property sizes, often may function as bases of convention formation.

Game theory predicts occurrences of inefficient outcomes in several “one shot games”, notably in the famous “prisoners dilemma”, but also in the “stag hunt” and other coordination games. More recent developments, including Brams’ “theory of moves” (but see Brams, 2001), and repeated games theory, have tended to narrow down the space for theoretically derived inefficiencies. In particular, experimental studies of “Coase-bargaining” situations indicate that people regularly

arrive at efficient (Pareto optimal) solutions even in situations where efficiency depends on the willingness of at least one party to accept very unfavorable divisions of immediate outcomes. (Shogren & al. 2002.) But these experiments allow participants to negotiate *perfectly enforceable contracts* that divide the outcomes more equally through side payments post hoc. Outcomes will likely be less efficient if contracts aren't perfectly enforceable, because, as noted by Skyrms ((2004), in this case the transition to a more efficient institutional arrangement may be viewed as a "stag hunt" where the less efficient outcome is at least as likely as the more efficient one.

The problems can be still more severe. Equilibrium outcomes of bargaining games depend critically on the institutional settings of the bargaining processes. (Binmore & Dasgupta 1987; Muthoo 1999.) These settings affect bargainers' options and information. Hence, they affect bargainers' ability to reach efficient solutions and their relative bargaining power. On the other hand, these institutional settings may, at least partly, also be viewed as the *results* of bargaining processes. Thus, institutions do not only affect agents' bargaining power, they are also *affected by* the bargaining power of those who construct them. (Knight 1992; 1998.) Therefore, the most powerful bargainers might not support the most efficient solution if and in so far as it affects their bargaining power in an adverse direction. (Bardhan 2001; 2005; Busch & Muthoo 2004.) The reason for their fear is probably not only that opportunism and unforeseeability make contracts about future compensation unenforceable. The dynamics of norms and conventions may also play a role. A contract negotiated under one set of institutional arrangements may come to appear as unfair under another set of arrangements and, hence, become unenforceable.

Experience tells us that norms often do have an impact on distributional outcomes. This occurs even in cases where the contending parties are free to bargain with no holds barred. In such cases the viability of the outcome depends on all parties' voluntary adherence to the norm. It seems likely that such norms, (as opposed to norms that are enforced by an authority), in some sense must be egalitarian in order to survive. According to Binmore (1998; 2005) the equality that counts when fair divisions are made is constituted by the results of past power battles. I.e. psychological and social mechanisms help people avoid unnecessary conflict by making them adapt their evaluations of each other's moral worthiness to the outcomes of prior distributional agreements, which in the medium run, (in cultural as opposed to Darwinian evolutionary time), are shaped by the reigning relations of bargaining power. Fair divisions and divisions based on power bargaining may diverge in individual cases. In the short run they may also diverge on average. Thus, today's fair outcomes may be based on yesterday's power relations. It also seems likely that fairness norms will adapt slowly to changing power relations in those cases where local contestants keep meeting each other under similar circumstances year after year. If this holds true we should also expect those who benefit from the local norms to put up resistance against institutional reforms that threatens to expose the prevalent norms to competition from (presumably less archaic) norms that might deprive them of their benefits.

The occurrence of more than two players is also a challenge to conventional theory. Ideally, n-person models should incorporate the possibility of coalition formation. This, however, often leads to a proliferation of equilibrium solutions and to an ensuing lack of predictability. One has to impose various kinds of restrictions on the actors' strategy choices to be able to derive unique solutions, and when this is done, one often comes up with other solutions than the Nash solution, for example the Shapley solution. (Shapley 1953; Perez-Castillo & Wettstein 2001.)

A frequently used device to solve the n-person bargaining problem is the introduction of majority vote rules. According to traditional public choice models the n-person “divide the dollar” non-cooperative game that corresponds to the majority vote procedure doesn’t have a Nash equilibrium. (Enelow 1997.) Game theorists have, however, demonstrated that unique subgame perfect equilibria actually do exist if certain agenda setting procedures are observed and the number of voting rounds is finite, or if parties choose identical strategies in identical subgames irrespective of voting histories. (Baron & Ferejohn 1987; 1989.) When parties to distributional decisions act according to such rules those who have the best opportunities to make proposals are advantaged. This advantage, however, is reduced whenever amendments are possible. Stable coalitions may of course also appear independently of whether these conditions apply or not. A minority coalition might for instance be able to attract enough other voters to win if it offers acceptable compromises and succeeds in keeping a nucleus of members in line with the help of “trigger strategies” etc., thus providing consistent voting records or other credible evidence that it is committed to a certain voting strategy. Experimental studies indicate that stable majorities that promote their own members’ interests tend to arise even in cases where people have very few clues to begin with as to who they might be able to cooperate with. (Walker & al. 2000.) But still we believe that the cohesiveness of a coalition is likely to be enhanced by mutuality or similarity of exogenously determined interests.

The above excursion into bargaining theory is somewhat eclectic, and some contributions are speculative. But it seems difficult to avoid this if one wants to use available bargaining theory to enhance the understanding of complex natural world phenomena. I therefore now venture to use the above as a basis for distinguishing between the following sources of bargaining power.

1. *Outside options.* The credibility of threats, and, hence, the power to force through an agreement that serves one’s own interests may depend on the outside options one has access to. Such powers increase in proportion to the attractiveness of the alternatives, provided that they are better than the outcome one might achieve if such options were unavailable.

2. *Coalition cohesiveness.* The power enhancing value of coalition membership depends on the coalition’s cohesiveness, i.e. on its capacity to *commit* a sufficient number of members to a common strategy. Such capacities might enhance a party’s ability to win votes, to endure protracted negotiations, and to exercise power based on outside options when such options depends on coordinated action. Cohesion is likely more easily sustained if members conceive of each other as equals (in particular with respect to outside options), and it also seems likely that members of small or tightly knit groups will manage to maintain a stronger sense of mutual duty than members of large groups.

3. *Timing capacity.* I have noted that the first bidder may have an advantage. I have also noted that it sometimes pays to wait for the right opportunity to move. The capacity to choose the right moment for one’s moves probably often depends on one’s informational resources, one’s formal position in the associations that the resource owners may have formed, and on the flexibility of one’s time schedule, all of which I expect to depend somewhat on one’s local social connections.

4. *Endurance ability.* Most bargaining theories emphasize the parties’ relative ability to hold out during protracted or expensive negotiations. This ability might depend on the ability to cover

bargaining costs or to suspend incomes derived from bargaining. It might also depend on how much time coalitions or individuals have for bargaining and on how desperate they are to win.

5. *Reputation*. Power may be based on reputation gained for a willingness to engage in potentially self destructive conflicts. As noted above, actors may gain such reputation by pure coincidence, but they may also consciously try to attain it. Negotiations over the division of output from renewable common resources are repetitive events, and this repetitiveness makes it possible for a party to start costly conflicts in order to build up reputation. Such strategies are probably most often chosen by actors that have some other powerbase at their disposal. Parties may also use reputation gained in other arenas as an asset in negotiations over resource utilization.

6. *Norms*. Distributional norms may be viewed as standardized, experience based solutions to recurrent distributional problems. But they may also get transferred through time or across institutional boundaries to similar looking but *essentially new* types of problems and situations. The idea that standardized, norm directed behavior get transferred from familiar institutional contexts to new ones, also seems to be Alvard's (2004) conclusion in his attempt to explain the dissimilarities in ultimatum game behavior between people who live in societies with differing degrees of market integration. I.e. the chances that the norms of market interaction get transferred to non-market contexts probably increases with the proximity to real markets and with the non-market institutions' similarity with market institutions.

In the following paragraphs I will attempt to show that these ideas (in so far as they hold true) might help us explain some puzzling aspects of Norwegian moose hunting benefit distribution.

Data and design

Data

I reanalyze data gathered in two Norwegian counties in 1997. Both counties have dense moose populations. Vest-Agder is located in South Norway and comprises 2.2 % of Norway's land area. Hedmark is situated north-east of Oslo along the Swedish border and comprises 8.5 % of the country's land area. (Some municipalities in southern and western Hedmark were, however, excluded from the study.) Vest-Agder is medium to small in terms of moose shootings (between 1,000 and 2,000 annually), whereas Hedmark is Norway's largest moose county. Normally, more than 7,000 moose are shot in Hedmark each year, whereas the aggregate number of moose shot in Norway annually normally ranges between 35,000 and 40,000.

We conducted mail surveys among randomly sampled registered hunters and landowners. One thousand hunters and one thousand landowners were sampled in each county. We received analyzable answers from 55 % of the hunters and 50 % of those landowners who owned parts of moose hunting grounds. The hunter survey also included a sample of Oslo residents.

The survey data are individual level data. Thus, they carry limited information about local and hunting ground level resource and outcome distributions. To compensate for this, and to get a more contextualized impression of local affairs than the questionnaire surveys could give us, we selected a few municipalities in each county and carried out informal interviews with wildlife

managers and landowners in each of these. We also interviewed wildlife managers employed by the county administration, and gathered some information on landowner association bylaws etc.

Design

The aim is to study the effects of power differences among users on the distribution of resource appropriation opportunities and on the efficiency of the appropriation process. This creates a need to compare the appropriation institutions and outcomes that occur in relatively homogeneous landowner associations with those that occur in more heterogeneous associations. The original study was not done with this task in mind, and, as indicated above, we have limited information about the power distributions that characterize individual hunting ground associations. But since I hypothesize a correlation between power and property size, and since our two study counties have widely differing property size distributions (Figure 1), this reanalysis has been designed as a comparison between the two counties. (We have information that proves that the structural differences between the counties are more than mere aggregate phenomena, i.e. that the internal property structures of the local landowner associations, with some regional exceptions, are more dispersed in Hedmark than in Vest-Agder.)

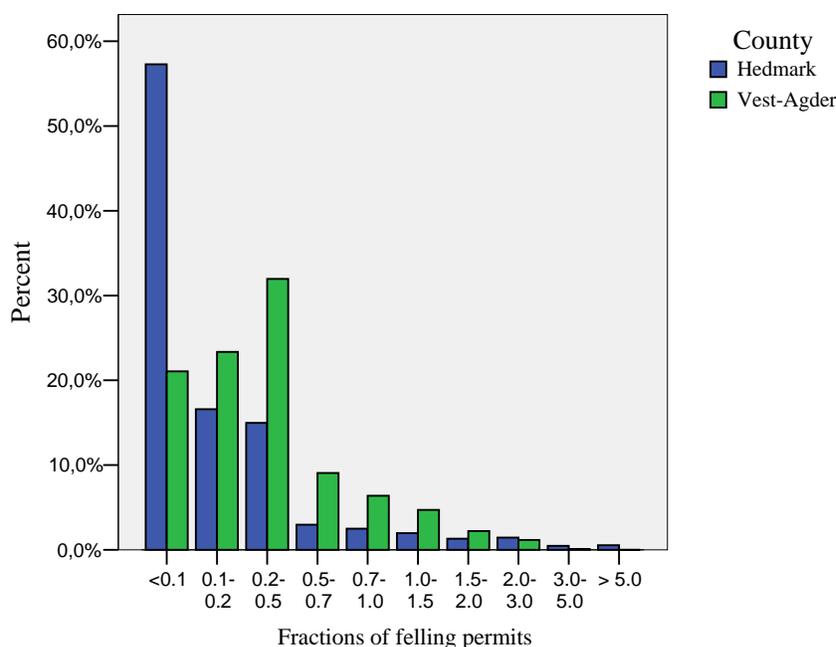


Figure 1. Percent of properties by county and property size (measured by fractions of felling permits)

The assumption behind this design is that differences between the appropriation institutions and outcome distributions found in Hedmark and Vest-Agder can be interpreted as effects of differences in property size heterogeneity. But they might of course also be the effects of other disparities, for instance different historical developments. Thus, this research cannot be taken as a critical test of the theory. However, the property size distributions of the two counties have not changed much during the last hundred years, and there are good reasons to believe that those traits of Hedmark moose hunting institutions that can be traced back to their pre-hunting law reform roots have been strongly affected by the inequalities that characterize this county's

property relations. And, since I haven't come across any really convincing alternative ideas about how the counties' institutional arrangements were driven in different directions, I have decided to go forward with a comparative analysis.

Description of the case: Institutional context and hunting practices

The moose management regime

One usually distinguishes between three different types of solutions to the appropriation externality problem: 1. External (public) regulation of utilization. 2. Introduction of institutional or physical devices that make it possible for single owners to exclude other users. 3. Maintaining common ownership while introducing mutually binding agreements or rules that put limits to each individual's utilization of the resource. (Ostrom 1990).

Norwegian moose management is based on a combination of all three types. The pivotal role, however, has been, and still to a large extent is, played by public laws and regulations.

Early modern Norwegian moose management regimes were characterized by severe appropriation externality problems and over-exploitation of the resource. This is still a potential threat, but, beginning in the 1950s, and especially from the 1970s onward, new management practices have prevented the threat from becoming really large. Landowners have for a long time had unalienable private ownership rights to all moose hunting on their own land. The authorities attempted to regulate the level of their hunting activities. These attempts were, however, not sufficient to make moose populations increase from their remarkably low levels. But this changed when a quota system was introduced in the early 1950s. Equipped with moose population estimates and population growth models etc., the game management authorities began fixing the annual numbers of felling permits. This system really started to affect population sizes and annual yield in a positive direction when managers began distinguishing between bull and calf shooting permits etc. In this context, however, the main point is that these permits were distributed between the landowners according to the sizes of their holdings. I.e. instead of getting one felling permit per property one would now need to control a minimum number of hectares in order to be permitted to shoot a moose. And for several reasons, including the fact that the number of holdings is larger than the number of felling permits, this forced more than 90 percent of the landowners to use their hunting rights in cooperation with their neighbors. Cooperative moose hunting was by no means a new practice in Norway, but now it had to be systematized through the creation of local land pools in the form of landowner governed hunting ground associations that controlled enough land to qualify for the assignment of at least one felling permit each. Most of the associations in our study counties seem to have had less than 20 members, but some had far more members. Individual landowners, in particular those whose properties are situated at the boundaries between two or more hunting ground association areas, have a certain freedom to choose which association to join. But most other hunting decisions, such as decisions about whether to lease out the hunting rights or not, whether one's own association should merge with a neighboring association, how the hunt should be performed, who should be allowed to form or become a member of a hunting team, and how the yield should be divided, have to be made collectively by the association members.

Moose hunting in Vest-Agder and Hedmark

Our data reveal that hunting grounds were leased out more often in Hedmark than in Vest-Agder. This holds true even if we look exclusively at those who owned no other hunting grounds than the ones they shared with their neighbors in a common ownership arrangement. In Hedmark 17 percent of this group reported that they leased out at least one of their commonly owned hunting grounds. In Vest-Agder the corresponding share was a mere 3 percent.

As indicated by these numbers most of the hunting grounds were used for hunting purposes by the owners. One aspect of this utilization is the hunting technique. Initially, we were surprised to find how different the techniques chosen in Hedmark were from those chosen in Vest-Agder. To keep things simple I distinguish between two main types of techniques, battue and other forms. A modern battue involves a relatively large number of unarmed beaters who drive the moose towards a smaller number of armed hunters that are posted on a line. The other group of techniques most often involves the use of dogs and requires that all hunters carry rifles. Both types of techniques are based on cooperation in teams. Norwegian moose-hunters seldom hunt alone. The former method requires more manpower than the latter. It is, in fact, difficult to come up with good reasons for limiting the number of beaters, and, hence, all property owners who want to participate as beaters will normally be allowed to do so.

Contrary to this, use of the other methods makes simultaneous participation of a large number of hunters unproductive or even dangerous. Hence, those who use such methods have (at least seemingly) ample excuses for not accepting the participation of all the property owners that might want to join their hunting team. Some of them may be left out, and the result is a more uneven distribution of recreational benefits than the one that is provided by a battue.

According to the hunter survey data, 86 percent of those who hunted moose in Vest-Agder used the battue technique, while only 3 percent of those who hunted in Hedmark used this technique. The data also indicate that 98 percent of those who hunted moose in Hedmark used other techniques, while only 35 percent of those who hunted in Vest-Agder used other techniques. Thus it seems that the technique that (presumably) lets all landowners join the hunting team is particular to Vest-Agder and practically not used in Hedmark at all; whereas the other techniques are far more common in Hedmark than in Vest-Agder.

We have asked experts why these differences are so pervasive, but the only explanations hunters and wildlife managers came up with were that they might be caused by the different “traditions” or by different “property structures”. The “property structure” argument seems tantamount to explaining the differences as caused by the needs narrow and symmetrical property size distributions create for hunting techniques that allow all owners to participate. The “tradition” argument, on the other hand, might just be an indication that the differences in property structures, (and the need to adapt the hunting technique to these differences), have prevailed for a long time.

After realizing that different hunting technique choices have different consequences for hunting opportunities, we wondered how the actual hunting team memberships were distributed. It turned out that owners’ chances of becoming hunting team members were not only strongly dependent on which county their property was situated in but also on the size of their property. (Figure 2.)

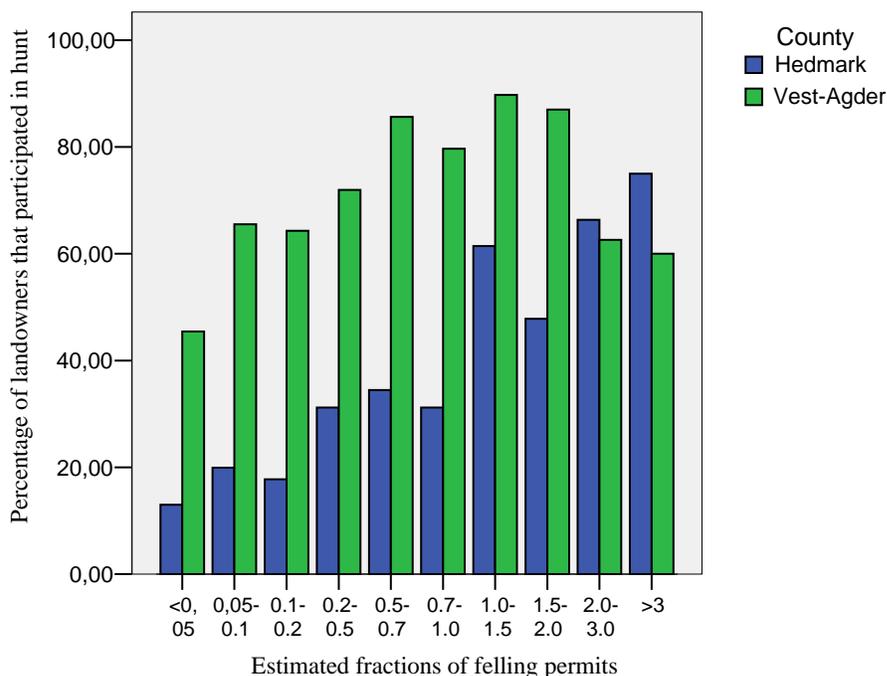


Figure 2. Percentage of hunt participants by property size (measured in estimated felling permits) and county

These inequalities arouse our suspicion that the owners of large properties somehow used their power to achieve better hunting opportunities than the rest. But in order to make this explanation stick I needed to find out why exclusive hunting was more attractive than non-exclusive hunting. It might be more fun, but also less fun, to hunt in the company of 6 rather than 30 people. There is however another, perhaps more plausible reason why the owners of large properties might want to exclude others from their hunting teams. The reason is meat and money. Hunting is a recreational activity, and people often pay several hundred dollars a day to participate in guided moose hunting without obtaining the right to keep as much as a pound of moose meat. Still, landowners who hunt normally get a hunters' meat share, which often seems to comprise about half of the meat. This share is usually equally divided between the hunters. Thus, those who are allowed to hunt not only get a free recreational experience on their neighbors' properties, they often also get larger shares of meat and money than they would if the yield were divided according to property size. This results in a leveling out of inequalities for those owners of small properties that are allowed to hunt, which occurs more often in Vest-Agder than in Hedmark. The opportunity to hunt is, however, strongly correlated with property size, and because of this there is also a tendency in the opposite direction, i.e. in the direction of a reinforcement of pre-existing inequalities.

Knowing this much one may also ask whether the resource was less efficiently used in Hedmark than in Vest-Agder. Lots of people in Norway and abroad are willing to pay for hunting ground leases or guided moose hunting experiences; and one may suspect that the participation level in Hedmark was too low for efficient utilization of the recreational opportunities.

In the next section I will take a closer look at the social mechanisms that in my opinion may have contributed to the production of these outcomes.

Analysis

In this section I aim to discuss the findings presented in the previous section in light of ideas presented in the theory section. The following chain of causation is implied: National institutions and dispersions of local property size distributions affect the distribution of power within the local hunting ground associations, which affects the choice of institutions or rules for distribution of appropriation positions and hunting yield. These rules and institutions in turn affect both the actual distribution of gains and the efficiency of the appropriation process.

With these ideas in mind I start the analysis with a presentation of the institutional arrangement types that the landowners most likely will have to choose among. I proceed with a discussion of how the landowners' bargaining power might be related to property sizes etc. on the one hand, and institutional arrangements on the other. Finally, I discuss how these associations between power structures and institutional arrangements may have affected the actual institutional choices and the ensuing distributional outcomes and efficiency levels.

The analysis must take account of the fact that those who hold formal ownership rights may lease out their hunting rights for a period of up to ten years, invite paying "guest hunters" to join the hunting team, or allow hunting team membership to be monopolized by a selected set of owners. I assume that those who possess the formal appropriation rights first bargain over these institutional arrangements before they, if necessary, bargain over who the hunters should be and how the meat should be allocated. These are complex negotiations that typically might be modeled as combinations of finite strategy choice games, (coordination games, chicken games and various hybrids), and continuous strategy choice bargaining games, all nested one within the other. The possible combinations are legion, and trying to make an explicit, formal and generally applicable model would probably be futile. It is, however, still possible to try to figure out how various types of power that are effective over a wide variety of game types may affect peoples' ability to achieve their preferred outcome types.

Alternative institutional arrangements

In theory, the landowners may choose from a virtually unlimited number of institutional arrangements. In practice factors such as the nature of the resource, laws, and pre-existing institutional repertoire narrow down the number of likely alternatives. I shall limit my discussion to what I assume are the most realistic alternatives. I make a pragmatic distinction between five main categories and assume that the landowners either unanimously select one of these, bargain over which to use, or somehow reach a settlement through one party's unilateral action. The alternative categories 1, 2, 4 and 5 have all been observed during our study, while alternative 3 is a theoretical construct in so far as we haven't observed any empirical occurrences yet, although it is known to be employed in other sectors and contexts. The five categories, which all refer to institutional arrangements within one single landowner association, are:

1. All those who hold a formal ownership right get access to appropriation positions and may participate in negotiations over the division of the yield.
2. The hunting grounds are leased out at market prices to anyone who is willing to pay, or the leases are auctioned out to whoever makes the highest bid. Those who hold formal ownership rights bargain and make decisions about the division of the income.
3. Appropriation position leases are auctioned out. Only those who hold formal ownership rights are allowed to make bids. They may all participate in negotiations over the division of the income, while only the leasers bargain over the division of the yield.
4. Some of those who hold formal ownership rights negotiate bilaterally with the others and buy them out. No further bargaining is necessary with or between those who are bought out, but those who have acquired hunting rights must decide how to divide the yield.
5. The holders of formal ownership rights bargain over how many members the hunting team should have; how memberships should be distributed, what portions of the meat hunting team members should be allowed to retain, and how the owners' input of hunting ground land should be rewarded.

Assumptions about institutional efficiency

I assume that each party will prefer the institutional arrangement that gives her the best expected, morally legitimate outcome. I also assume that the preferences for such arrangements depend on each party's preferences for hunting, the combined net value of the entire hunting project under each solution, and each party's chances to acquire a large share of that value.

In speaking of the net value of an appropriation project I assume that we can ascribe transferable, monetary value to it, i.e. that people would accept a particular sum of money as compensation for the loss of a part of the project, or are willing to pay a particular sum of money in order to acquire a certain part of it. I take the value of the meat yield to be a constant. But the value of the recreational aspect of hunting certainly depends on who the hunters are. The most efficient solution is to let those people hunt who value the activity the most, and to increase the number of hunters as long as this adds to the total net value of the activity. (If people value the activity negatively the efficient solution would be to let those hunt that have the least negative opinions about it or are the most efficient hunters.) But this is not what we should expect to see if institutional arrangement 5 is chosen. Under these rules people don't have to pay the full price of an appropriation position, and hence, the positions will be distributed according to power differentials of the kind discussed above rather than according to preferences and willingness to pay. In particular, this will be the case if each appropriation position is tied to a moral right to retain a certain part of the yield. Such a rule might even tempt those owners who value the activity negatively to become hunters in order to get a portion of the meat. Similar inefficiencies may ensue whenever rules create quantitative ties between the shares people receive of goods that they have less than perfectly correlated preferences for. See a formal, although indirect, demonstration of this point in Libecap & Smith (2001).

In some ways arrangement 2 is the most radical alternative to arrangement 5. It avoids many of the latter's problems. Those who value hunting most (in monetary terms), or have the least negative valuation of it, will be recruited, and, hence, the gross income will be maximized, provided that marketing is adequate. But marketing is not cost free, and there may also be guiding and surveillance costs related to outsiders' usage of local resources. Therefore, gross income increases earned on appropriation leases must be significant in order to justify selection

of arrangement 2 on efficiency grounds. But when national lease levels are high enough, this solution will likely be the most efficient in terms of net economic value.

Arrangement 3 would normally eliminate most of the marketing, guiding and surveillance costs of alternative 2, but the potential incomes would also be smaller, and the auctions would probably be more prone to manipulation by powerful owners.

Arrangement 4 implies decentralized lease price bargaining between the owners of the formal appropriation rights. This might work like an internal market for appropriation right shares where an equilibrium price equalizes supply and demand and allocates the appropriation positions efficiently. But it seems likely that such small local markets are even more prone to manipulation and inefficiencies than the centralized strategy of complete lease auctions under rule set 3.

We also note that the choice of market-based solutions may disrupt relations between hunting mates and feed new social divisions based on purchasing power. Whether this should be regarded as a net efficiency loss or not will, however, depend on the quality and effects of new versus old relations. The change might go in either direction. But introduction of new market-based solutions will cause a redistribution of social gains, and the winners will be those who have money, are interested in hunting, and have had little prior access to hunting opportunities.

All in all, it is not possible to tell a priori which rule set is the most efficient. Rule efficiency depends on several variable, exogenously determined factors. But in most instances it seems likely, for the reasons given above, that sets 1, 2 or 3 are more efficient than sets 4 and 5.

Bargaining power in moose hunting right owners

Now, what determines an individual actor's ability to get a good outcome? First I repeat the point made in the theory section, that in a world with perfect foreseeability, no transaction costs, and no moral limitations on choice availability, everyone might get a better outcome if they could switch to a more efficiency-promoting rule set. But we don't live in such a utopian world, and hence, the side payments that are necessary to improve everyone's outcome and to attend to everyone's sense of fairness when rules have changed, cannot be guaranteed. This means that some may gain and some may lose by efficiency improving rule changes. Who the losers and winners will be depends on which distributions of bargaining power each rule set supports. Therefore, let me first discuss what bases of bargaining power that might matter and who the holders might be.

1. Outside options. If individual parties or coalitions of parties can pull their part of the common hunting ground's acreage out and use it as a separate hunting ground or as part of another common hunting ground, then they have an outside option, and if this option is expected to bring significantly better outcomes than the prevailing one, they will likely break out sooner or later, and the remaining parties will be left with what their part of the hunting ground may produce, or with a temporary halt in hunting activities. This gives the parties a power to demand agreements that match their outside alternatives. The authorities demand that hunting grounds satisfy a minimum size requirement. Therefore, every party that intends to use outside options as a basis for bargaining power at all must either possess a holding that satisfy this requirement, or they must be able to muster a stable coalition that possesses such a holding in common. In addition, the power that such outside options bring about doesn't only depend on their fulfillment of minimum size requirements. It also depend heavily on the exact sizes of the holdings; and so we

would expect to see a relatively strong correlation between the size of a party's property and the share that it obtains of the common hunting ground's output of benefits. Still the outcome would probably not be identical to a market solution in which all output is distributed according to property sizes. Splitting of old and creation of new hunting ground associations entail potentially large transaction costs, and all those who consider breakaway strategies must assess whether gains will be larger than costs. Furthermore, the costs will likely be particularly large compared to gains for those who hold small properties because of the complex coordination tasks of an alliance of many small members. Hence, holders of small properties are more likely than holders of larger properties to lack outside options and to be vulnerable to other types of power use.

2. *Coalitions*. As mentioned in the previous paragraph, membership in a coalition may enhance a party's ability to exercise power based on outside options. Being member of a stable coalition is also important whenever decisions about distributional issues are made by majority vote. As noted in the theory section, the cohesiveness of a coalition is likely to be enhanced by mutuality or similarity of interests. Similarity and mutuality of interest will to some extent be synonymous with similarity of outside options because parties with similar outside options may have to invoke these options in a coordinated manner. Thus, in the moose hunting case similarity of property sizes is a likely base for coalition formation. The effect this may have on the evolution of majority coalitions might depend on the associations' property size distributions. Normally, size distributions are positively skewed, which could imply that it is easier for owners of small than for owners of large properties to establish stable coalitions. Still, it is probably more important for coalitions to have their members aligned along one single interval on the size scale than to make this interval as narrow as possible, and, as mentioned above, organization of coalitions might cost less compared to gains for owners of large properties than for owners of smaller properties. Furthermore, the stability of a coalition is likely enhanced if it rests on mutual trust acquired during previous cooperative activities. Owners of larger properties traditionally often occupy leading positions in local organizations. This may have gained them a more continuous experience of cooperation than other landowners and provided them with an advantage as coalition builders.

3. *Timing*. In bargaining situations with discrete strategy sets those who move first may be able to lock the game into the equilibrium that suits them best. For instance, if appropriation positions are up for grabs, and no auction or market system is in place, it might pay to grab the positions fast, instead of waiting until someone else puts up a competing bid. The ability to move fast depends, among other things, on knowledge and a flexible time schedule; which in turn depends on the party's local social relations, her prior experience with local hunting etc., and a flexible job situation. It seems likely, partly due to what has been said in the previous paragraphs and partly because they normally live on their properties, that holders of larger properties fare better on these variables than holders of smaller properties.

4. *Endurance ability*. If a party's ability to hold out temporary conflicts seems high enough to deter others from opposing it, then it may force the others to accept its demands for a discrete alternative that favors its own interests, which for example might be a demand to take charge of the selection of hunting team members. Traditionally, wealth has been regarded as a factor that might enhance peoples' ability to hold out during conflicts. Wealth could have this effect in the hunting case too; especially when the parties need to hire lawyers. But in most types of conflicts between Norwegian hunting right owners the ability to hold out will likely depend more on

coalition size and ability to mobilize local support than on wealth. This might tip the scale in favor of local residents, and, (if I got things right in the previous paragraphs), the owners of larger properties.

5. *Reputation.* The ability to hold out during temporary conflicts brings power by making credible peoples' threats to oppose their contenders. The power of threat credibility may also be based on the party's reputation as an opponent that never yields. For instance, the reputation won by landed proprietors and prosperous farmers for their ability to subdue smallholders, cotters and rural workers during not-so-past periods of Norwegian history might still persist and set its mark on relations between landowners in regions like middle and southern Hedmark, which used to be known for their deep class divisions.

6. *Norms.* As explained in the theory section, I expect norms that depend on the transacting parties' voluntary adherence and enforcement, to be, in some sense, egalitarian. The traditional norm seems to be that hunters receive equal parts of the meat harvested by their team. This norm is adapted to a situation in which moose hunting is work, and thus something most farmers won't engage in if they have more profitable jobs to do. Things changed when hunting rights got differentiated according to property sizes and moose populations started to grow while at the same time increasing affluence made people raise their demand for hunting as a recreational activity. In this new situation it might make sense to break out of local associations to exploit the potential market value of large moose hunting rights. Thus, some of the local landowner associations felt that they needed to adapt to these approaching market forces. The national farmers' and forest owners' associations started to exert pressure on the more reluctant local associations to make them monetize their transactions and divide meat or money in proportion to property sizes. Strikingly, however, the tradition that grants the hunters' a separate meat share survives alongside the more market oriented property size based norm. Thus, meat and money are distributed according to hunting efforts as well as according to property size; and very often both principles are applied simultaneously. Regarded separately, the first norm empowers those who are allowed to hunt, while the second empowers those who hold large properties.

7. *Wealth.* All the six sources of power mentioned above are local sources of local power. What about wealth, the generalized medium of economic power? It can be used to buy assistance during conflicts and to fund coalition-building. But in local, small-scale disputes time and social ties are probably more important. However, purchasing power becomes decisive whenever hunting opportunities are distributed by means of market mechanisms. Rural landownership is no longer an important source of wealth, and the distribution of wealth may be quite different from the distributions of the powers we have discussed in the previous paragraphs. The introduction of market mechanisms may therefore lead to redistribution of hunting team memberships.

The actual choices of institutional arrangements

Now, let us go back to the choice of institutions. Power based on outside options can be used under all institutional arrangements. But while the effectiveness of wealth depends on the use of market mechanisms such as in arrangements 2 and 3, power based on the other sources are more effective under the other arrangement types. The ones that are least adapted to the use of wealth are arrangements 1 and 5. Number 5 render extensive use of non-monetary power possible, while arrangement 1 only gives limited scope for use of power that doesn't emanate from outside options or moral norms. Which implications do this have for the choice of rule set? I don't expect

wealth to have a strong impact on this choice. Thus, I expect that the other types of power will have the strongest impact. When some parties' possessions of local power are significantly larger than those of other parties, we expect that they will be able to select an institutional arrangement that supports the use of coalition, endurance, timing and reputation based power. If such powers are more evenly distributed I expect people to choose an institutional arrangement that doesn't give quite as much scope for the use of this kind of power.

Arrangement 1 gives little scope for the use of local powers and produces the most even distributions. It doesn't only produce a more equal division of recreational benefits than the other alternatives, but likely also a division of money and meat that is at least as equal as the other arrangements. I would definitely expect it to occur more often in areas with evenly distributed property sizes than in areas with uneven distributions. In other words: I would expect it to occur more often in Vest-Agder than in Hedmark.

The second alternative, leasing of the entire hunting ground to non-members, may occur in areas where property size distributions are even as well as in areas where they are skewed. There is always a chance that a majority of the landowners would prefer to lease out the hunting ground because they lack the required preferences, time and fitness for hunting, or because they prefer money to moose meat. But where power is unevenly distributed even a minority of landowners might sometimes be able to force through an outleasing solution. Thus, I expect to see more frequent occurrences of this arrangement in Hedmark than in Vest-Agder. But outleases incur marketing and surveillance costs. In addition, those large property owners who prefer this solution will often find it difficult to establish sufficient support. Thus, the overall occurrence of leasing solutions will likely be rather limited unless lease rates rise significantly above the corresponding meat prices. Another reason for this is that, under the present tax law, incomes from lease contracts are more heavily taxed than the incomes landowners derive from their own hunting activities.

The third alternative is, as noted above, just a hypothetical possibility. The fourth and fifth types of institutional arrangements are, respectively, those where the hunting landowners make bilateral agreements with non-hunting landowners about compensations for the use of the latter's part of the hunting ground, and those where the hunting ground association members make decisions in common about the compensation rates and the distribution of meat or money. Both arrangement types likely prepare the ground for a quite skewed distribution of outcomes; so I expect them to occur more frequently in Hedmark than in Vest-Agder.

As summarized in the following three paragraphs all these derivations are confirmed by the data.

1. As we know already, the techniques chosen in Vest-Agder let a far higher percentage of the landowner families hunt in this county than in Hedmark.
2. As noted in the previous section, the second institutional arrangement type, outleases of hunting grounds, was also distributed according to our expectations. Their overall frequencies are small and they are more frequent in Hedmark than in Vest-Agder.
3. The two remaining institutional arrangements in use occur more frequently in Hedmark than in Vest-Agder. Unfortunately, our data doesn't allow us to count the occurrences of each one of the

two varieties, but our interviews indicate that both are relatively common in Hedmark, and that occurrences of both types may be found within a distance of a few miles from each other. One of them is characterized by rather informal processes where, typically, some landowners create a hunting team, pool their own properties together as a first basis for the establishment of a hunting ground, and then go scrambling for the remaining local landowners' land through a bidding process where the lease rates are determined through bilateral negotiations, (normally resulting in equal rates per hectare for adjacent properties), and where they may have to compete with other hunting teams. The level of competition varies. In some instances hunting teams may manage to avoid competition through skilful maneuvering, invocation of traditional practice, threats of ostracism, or some other kind of force. Sometimes these arrangements lead to frequent "movements" of individual plots of land from one hunting ground association to another. The use of democratic devices, such as landowner meetings and voting procedures seems to be quite limited. The other type of arrangement is characterized by formal organizational procedures and formal decisions about the division of outcomes within landowner groups and between hunters and landowners. But the formation of hunting teams is pretty much an informal process in these instances too. For instance, in one of our local study areas those who want to sustain or create a hunting team normally convince other landowners to let them use their hunting rights. When this is achieved they apply for felling permits and a designated hunting ground. The application is sent to the owner-controlled game management association, which handles the money transfers and assigns them a hunting ground provided that the area they control is large enough. Their assigned hunting ground will be situated somewhere in the local area but not necessarily on the land that they base their claims to felling permits on. This arrangement makes it relatively easy for people who own non-adjacent properties to pool their land into a common hunting ground, but it also provides ample opportunities for quarrels to arise over the proper delineation and assignment of hunting grounds. The most common practice, though, seems to be that informal agreements within the landowner associations make certain that particular hunting teams get to control particular hunting grounds

Institutional arrangements and distribution rules

As noted above, it may be possible for the most powerful to implement arrangements that let them extract more than the market value of their part of the hunting ground. This may sound like a difficult goal to legitimize, but, as indicated in the paragraph on norms, the trick seems to be to invoke the notion of hunting as work. I.e. first one lets the "deep rooted" hunting technique tradition legitimize a select group's hunting privileges, and then one lets the notion of hunting as work legitimize the select group of hunters' right to a special meat share in addition to the share they receive as landowners.

The distribution of rationed hunting team memberships likely depend on informal bargaining and tradition rather than on rules. But the distribution of meat must be based on rules in order to prevent haggling and quarrels over the division of every single moose. Thus, I expect landowners to bargain over rules for the distribution of meat or monetary meat equivalents. When both property sizes and the chances of becoming hunting team members are relatively evenly distributed, it doesn't matter much whether the yield is distributed according to property sizes or according to hunting effort. Under such circumstances one might expect much variation in the yield distribution rules, and again, it seems that the Vest-Agder case, at least to some extent, supports this argument. In Vest-Agder non-hunting landowners may acquire anything from equal meat shares, via meat shares that are proportional to the sizes of their properties, to no meat at all.

We even found cases in which the landowners got all the meat in their capacity as landowners, and where no hunters' shares were awarded at all. But when property sizes, power and the chances of joining the hunting team are unevenly distributed, as in Hedmark, the distribution rules become more important. Distribution rules that don't divide at least part of the yield according to property sizes may not be sustainable. Thus 67 percent of our Hedmark respondents claimed that compensation was distributed according to the size of the landowner's holding, whereas only 30 percent of our Vest-Agder respondents said the same thing. But those landowners that have power enough to obtain hunting team membership will likely also often prefer distribution according to hunting effort. The result is often a 50/50 split between a landowners' share and a hunters' share, which might lead to a situation where a minority of owners not only get a free recreational experience on their non-hunting neighbors' properties but also acquire a meat share that is more than proportional to their share of the hunting ground.

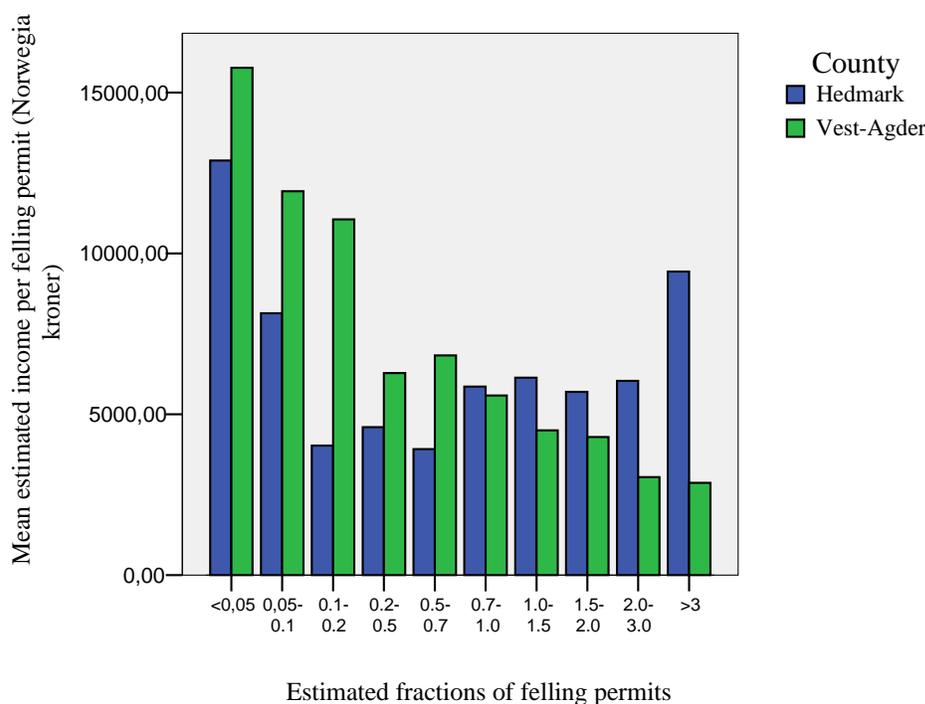


Figure 3. Estimated income per felling permit measured in money units by county and property size (measured in fractions of felling permits)

A closer look at our data reveals that the distribution of meat (and monetary meat equivalents) is not the same in Hedmark as in Vest-Agder. The average summated reward per felling permit received by landowners in the lower property size strata are lower in Hedmark than in Vest-Agder, whereas the opposite is the case in the upper property size strata. (Figure 3.)

The main tendency is that the average reward per felling permit decreases with property size. The decrease is far less marked in Hedmark than in Vest-Agder. Therefore, I cannot claim that the data clearly confirm that the inequalities that characterize the landowner populations of Hedmark are reinforced through the meat distribution arrangements. Rather, they are largely reproduced, whereas, on the other hand, the inequalities of Vest-Agder are being leveled out. Thus, the

institutional arrangements that prevail in Hedmark prevent the owners of the larger properties from exposure to the kind of leveling process that goes on in Vest-Agder. In addition to this they have a privileged access to recreational experiences. I cannot estimate the market value of the recreational gains but they are positive, and thus the effect still seems to be that the average local output per felling permit increases with property sizes in Hedmark.

The finding of a positive association between hunting team membership and property size is confirmed by a logistic regression analysis in which I also check the effects of some other factors that, in addition to or as mediator of property size, may empower landowners to join the hunting team. One might, for instance, expect that being a local resident, and thus a member of the local community, would enhance a landowner's power and, hence, her ability to acquire a position on the team. Living off the land integrates people in the local landowner community, and might not only increase their knowledge about the gains of hunting, but also their interest in acquiring these gains. I therefore test whether full time farmers and people who live off their land are more likely to hunt moose than other landowners. One would also expect that gender, age, and preference for hunting have an impact on people's chances of becoming hunting team members. All kinds of hunting are still dominated by men. A person's ability to hunt sometimes decreases with age, but younger landowners (in Hedmark at any rate) also have to wait for a while before they are allowed to take over their parents' positions on the hunting team. I therefore test for a curvilinear association between age and the log odds of hunting team membership. All these expectations, except the one about full time farmers' higher probability of becoming hunters, are corroborated by the data. (Table 1.) The relatively small N is due to elimination of those who own an entire hunting ground, lease their hunting ground out, or haven't answered some of the questions. Analyses that include more respondents show essentially the same results.

I also checked whether the number of landowners who held shares in the hunting ground had any impact on each landowner's chances of becoming a hunting team member. One might reason that the chances are better where there are few owners than where there are many. But, as the regression results reveal, this doesn't seem to be the case. What we actually see here is that the size of the hunting team can be stretched and reduced to fit the number of owners even where other techniques than battue is used. (This relationship is actually due to the Hedmark data.) I interpret this as still another indication that the low number of participants in the non-battue areas is not so much a result of the hunting technique per se as a result of a pressure to keep some of the owners out.

The results don't support my suspicion that income levels have little impact on landowners' chances at participating in moose hunts. The observed association may be due to power effects but it might also be that people with higher incomes have more flexible time schedules etc., and hence a higher ability to participate. I also expected that the effect of property size would be smaller in Vest-Agder than in Hedmark because of the presumably lesser leverage for size-based power display in Vest-Agder's hunting ground associations. There is a difference but it is not statistically significant. What we actually do observe is that there are two levels of hunting team participation in Vest-Agder. There are those who carry rifles, and there are those who participate as beaters. Formally, both groups have equal rights, except for the right to fire shots, which evidently belongs to a select group of people. And the chances of being a member of this select group in Vest-Agder are almost as dependent on property size as the chances of being a member of a hunting team are in Hedmark. Being a beater, on the other hand, is not dependent on property

Table 1. Logistic regression; Dependent variable "Participated in last year's moose hunt" (Yes = 1, no = 0). N = 607

	Coefficient B Model 1 ^a	Coefficient B Model 2 ^b	Coefficient B Model 3 ^c
Property size (estimated fractions of felling permits)	1.676***	1.470**	1.644*
Vest-Agder County	2.258***	2.393***	2.575***
Property size * Vest-Agder County	-1.068	-0.951	-1.427
Respondent lives off property		0.303	0.565
Female respondent		-1.016**	-0.219*
Age in years		0.138*	0.166*
Squared age in years		-0.001**	-0.002*
Resident of municipality where property is situated		0.871**	1.235***
Number of owners of commonly owned hunting ground		0.006	0.010
Last year's household income in 100,000 Norwegian kroner		0,141	0.275*
Degree of negative preference for moose hunting (four point scale: Like very much = 1, Don't like at all = 4)			-1.677***
Constant	-1.323	-4.556	-3.927*

a. -2 Log likelihood = 671,217

b. -2 Log likelihood = 619,581

c. -2 Log likelihood = 422,909

d. * p < 0.05; ** p < 0.01; *** p < 0.001

size. These results were obtained using multinomial logistic regression. (Table 2). The implication is that all Vest-Agder's property size groups send an almost equal percentage of beaters to the hunt each year, and that small properties don't compensate for smaller quotas of riflemen by sending larger quotas of beaters. The association between property size and hunting team participation as an armed hunter, as well as the lacking association between property size and hunting team participation as a beater, holds up when we check for participation of family and relatives of the property owner. In fact, our interviews provide evidence that some of Vest-Agder's hunting teams consciously use property size as a criterion when they select their riflemen, and that the reason for this seems, again, to be power differentials based on differences of outside options. But these power differentials are smaller in Vest-Agder than in Hedmark, and our hypothesis is that this has forced the owners of larger properties to let the owners of smaller properties join the hunting team as beaters and collect hunters' meat shares that are identical in size and content to the ones the riflemen collect. One remaining question is however why the owners of smaller properties don't fill up hunting the teams with more beaters. I don't know, but maybe the power distribution, after all, has an impact on participation rates in Vest-Agder too.

Institutional arrangements and efficiency

I have argued that the institutional arrangements most commonly used in Hedmark are oriented towards the interests of the owners of middle sized properties, and that these interests tend to

Table 2. Multinomial logistic regression with dependent variable: Moose hunting participation mode. Respondents who own properties in Vest-Agder.

Categories dependent variable		Coefficients Model 1 N=372	Coefficients Model 2 N=323	Coefficients Model 3 N=323
Hunted with rifle (Model 1: N=109)	Intercept	-.167	2.428	4.655
	Property size (estimated fractions of felling permits)	1.070**	.597	.249
	Respondent lives off property		.096	.635
	Female respondent		-1.881*	-1.891
	Age in years		-.052	.022
	Squared age in years		.000	-.001
	Resident of municipality where property is situated		1.419**	1.966***
	Number of owners of commonly owned hunting ground		-0.041*	-0.055*
	Last year's household income in 100,000 Norwegian kroner		0.401**	0.433*
	Degree of negative preference for moose hunting (four point scale: Like very much = 1, Don't like at all = 4)			-2.318***
Hunted as beater (Model 1: N=132)	Intercept	.348	-2.137	-.921
	Property size (estimated fractions of felling permits)	.209	.181	.031
	Respondent lives off property		-.154	.090
	Female respondent		-.564	-.098
	Age in years		.076	.094
	Squared age in years		-.001	-.001
	Resident of municipality where property is situated		.200	.471
	Number of owners of commonly owned hunting ground		.021	.015
	Last year's household income in 100,000 Norwegian kroner		0.314*	0.293*
	Degree of negative preference for moose hunting (four point scale: Like very much = 1, Don't like at all = 4)			-1.062***

a. The reference category is: Did not hunt

b. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

exclude other users at the cost of efficiency. I have also argued that the institutional arrangements used in Vest-Agder are likely to be more efficient than those used in Hedmark because they open up hunting opportunities for a wider range of people. It is not possible to prove this through documentation of the recreational values produced per moose under the respective arrangements. But there are some indications that I may be right. In Hedmark, 22 percent of the respondents said that they participated as hunters *and* that they liked moose hunting very much. The corresponding portion in Vest-Agder was almost two times as high, (39,5 percent). I also found that in Hedmark, 8 percent of the respondents said they like moose hunting very much, but still don't participate. The corresponding portion in Vest-Agder was only 3 percent. These numbers don't measure the overall satisfaction level but they point in the expected direction. It is, by the way, striking how closely the interest in hunting is correlated with the opportunities to hunt. The expressed interest for moose hunting is far higher among landowners in Vest-Agder than in Hedmark. And since we have no reason to believe that people in Hedmark are inherently less interested in this activity than people in Vest-Agder, I believe that the number of hunters who hunt and appreciate the hunting experience would increase over time if the Hedmark landowners replaced their institutional arrangements with those used in Vest-Agder.

Conclusions

Based on various bargaining and game theoretical contributions I have argued that:

1. The internal power relations of a commons are affected by: a. The distribution of member characteristics. b. Market situations and institutional contexts such as national laws and policies. c. Local norms and conventions
2. These power relations affect choices of internal institutional arrangements in such a way that these arrangements: a. Tend to legitimize the prevailing power relations. b. Distribute outcomes in a way that reflects the power distributions.
3. The beneficiaries of uneven power distributions may sustain inefficient institutions in order to retain their privileges.

I have tried to figure out whether the Norwegian moose hunting case can be understood in the light of these ideas.

Starting with the ideas in point 1 I find that the distribution of power among local moose hunting ground co-owners clearly depended on property sizes. The importance of property size was mainly due to the national moose management system and the high market value of moose hunting leases. But it also seems likely that property size based power was enhanced by inherited conventions, and that such conventions were more widespread in regions where uneven property sizes created particularly deep class divisions in the past. Finally, the data are consistent with the hypothesis that degree of connectedness to the local community creates power.

The case data are, at least to a certain extent, in agreement with the ideas stated in point 2 too. I find that the hunting ground associations of the county with the widest dispersion of property sizes applied hunting technique conventions that made the exclusion of less powerful hunting right owners from hunting teams possible; whereas the associations of the other county, which is characterized by more even property size distributions, applied techniques that allowed all owners to join a hunting team. The expected outcome is that hunting team membership was more

strongly correlated with property size in the former than in the latter county. What I actually find is that there was a strong association between property size and hunting in the former county and that the average hunting participation rate was far smaller in this county than in the latter, but, although I estimated a weaker association between property size and participation rate in the latter county, the difference in correlations is not statistically significant. Hence, property sizes had an impact on participation opportunities in both counties. Furthermore, I find that the hunting ground associations tended to avoid institutional arrangements (leasing arrangements etc.) that would make the distribution of meat and monetary outcomes exactly proportional to property sizes. Instead, they tended to choose arrangements that upheld the anachronistic norm that hunters deserve a special reward for being willing to join the hunting team. This evidently favored those who were powerful enough to be allowed to hunt, and thus one might expect it to favor the average owner of larger properties. But, since all hunters got equal parts of the hunters' share, the average relative gain (compared to what they got for their land input) was higher for those owners of small properties that were allowed to hunt than for the owners of large properties, and, since the number of small properties is higher than the number of large properties, the final result seems to be that the average tangible outcomes received by landowners in the county with the widest property size dispersions were approximately proportional to the sizes of their properties. In the other county the owners of large properties received a portion of the tangible outcomes that was smaller than their portion of the land input. Thus, it seems that the most influential property owners weren't able to use their power to provide the average owners of large properties with a disproportionately large part of the tangible outcome. Even in the county with the widest property size distributions those owners of large properties that hunted had to share their extra gains with a considerable number of hunting small property owners. We may conceive this as the price they have to pay for the opportunity to extract extra gains by invoking the norm that hunters should be paid for their services. And the owners of large properties still get a disproportionately large share of the total outcomes in this county if we, in addition to the tangible outcomes, include the value of the recreational experiences in the calculation.

As for the idea in point 3, I contend that attempts to defend the privileges discussed in the preceding paragraph may have induced the most powerful owners in the county with the least even property size distribution to prevent a more efficient utilization of the recreational aspect of moose hunting.

Litterature

- Alvard, M. S. 2001. Mutualistic Hunting. In *Meat-eating and human evolution*, eds. C. B. Stanford & H. Bunn, 261-278. New York, Oxford University Press.
- Alvard, M. S. 2004. The Ultimatum Game, Fairness and Cooperation among Big Game hunters. In *Foundations of Human Sociality: Economic Experiments and Ethnographic Evidence from Fifteen Small-Scale Societies*. Eds. J. Henrich, R. Boyd, S. Bowles, C. Camerer, E. Fehr & H. Gintis. Oxford, Oxford University Press. Pp. 413-435.
- Alvard, M. S. & D. A. Nolin. 2002. *Rousseau's Whale hunt?* Current Anthropology 43:533-559.
- Bardhan, P. 2001. Distributive Conflicts, Collective Action, and Institutional Economics. in G.M.Meier and J.E. Stiglitz, *Frontiers of Development Economics: The Future in Perspective*, Oxford, Oxford University Press

- Bardhan, P. 2005. *Scarcity, Conflicts, and Cooperation: Essays in the Political and Institutional Economics of Development*. Cambridge, Mass., MIT Press.
- Baron D. P. & J. Ferejohn. 1987. *Bargaining and Agenda Formation in Legislatures*. *American Economic Review* 77 (2): 303-309
- Baron D. P. & J. Ferejohn. 1989. *Bargaining in Legislatures*. *American Political Science Review* 83 (4): 1181-1206.
- Binmore, K. 1987. Nash Bargaining Theory II. In *The Economics of Bargaining*, eds. K. Binmore & P. Dasgupta, 61-76. Oxford, Basil Blackwell.
- Binmore, K. 1998. *Just Playing: Game Theory and the Social Contract. Volume II*. Cambridge Mass., MIT Press.
- Binmore, K. 2005. *Natural Justice*. Oxford, Oxford University Press.
- Binmore, K & P. Dasgupta. 1987. Nash Bargaining Theory: An Introduction. In *The Economics of Bargaining*. eds. K. Binmore & P. Dasgupta, 1-26. Oxford, Basil Blackwell.
- Binmore, K., C. Proulx, L. Samuelson & J. Swierzbinski. 1998. *Hard Bargains and Lost Opportunities*. *The Economic Journal* 108:1279-1298.
- Binmore, K., L. Samuelson & P. Young. 2003. *Equilibrium Selection in Bargaining Models*. *Games and Economic Behavior* 45:296-328.
- Binmore, K., A. Shaked & J. Sutton. 1989. *An Outside Option Experiment*. *Quarterly Journal of Economics* 104:753-770.
- Brams, S. J. 1990. *Negotiation Games: Applying Game Theory to Bargaining and Arbitration*. New York, Routledge.
- Brams, S. J. 1994. *Theory of Moves*. Cambridge, Cambridge University Press.
- Brams, S. J. 2001. *Response to Randall Stone: Heresy or Scientific Progress?* *Journal of Conflict Resolution* 45:245-254.
- Bush, L-A. & A. Muthoo. 2004. *Power and Inefficient Institutions*. Working Paper. Version as of April 29. <http://privatewww.essex.ac.uk/~muthoo/agenda.pdf>
- Camerer, C. F. 2003. *Behavioral Game Theory*. Princeton, NJ, Princeton University Press / Russell Sage Foundation
- Edgeworth, F. 1881. *Mathematical Psychics*. London, Kegan Paul.
- Elster, J. 1989. *The cement of society*. Cambridge, Cambridge University Press.
- Enelow, J. M. 1997. Cycling and Majority Rule. In D. C. Mueller (ed.): *Perspectives on Public Choice: A Handbook*. Cambridge, Cambridge University Press. Pp.149-162.
- Hackett, S., D. Dudley & J. Walker. 1994. *Heterogeneities, Information and Conflict Resolution: Experimental Evidence on Sharing Contracts*. *Journal of Theoretical Politics* 6:495-525.
- Hardin, R. 1982. *Collective Action*. Baltimore, Resources for the future / Johns Hopkins University Press
- Hargraves Heap, S. P. & Y. Varoufakis, 2004. *Game Theory: A Critical Text. Second Edition*. London, Routledge.
- Hart, S. & A. Mas-Colell. 1996. *Bargaining and Value*. *Econometrica* 64:357-380.
- Hawkes, K. 2001. Is Meat the Hunter's Property? Big Game, Ownership, and Explanations of Hunting and Sharing. In *Meat-eating and human evolution*, eds. C. B. Stanford & H. Bunn, 219-236. New York, Oxford University Press.
- Knight, J. 1992. *Institutions and Social Conflict*. Cambridge, Cambridge University Press.
- Knight, J. 1998. Models, Interpretations and Theories: Constructing Explanations of Institutional Emergence and Change. In *Explaining Social Institutions*. J. Knight & I. Sened eds. Ann Arbor, University of Michigan Press. Pp. 95-119.

- Libecap, G. D. & J. L. Smith. 2001. *Regulatory Remedies to the Common Pool: The Limits to Oil Field Unitization*. *The Energy Journal* 22:1-26.
- Muthoo, A. 1999. *Bargaining Theory with Applications*. Cambridge, Cambridge University Press.
- Napel, S. 2002. *Bilateral Bargaining*. Berlin, Springer Verlag.
- Nash, J. F. 1950. *The Bargaining Problem*. *Econometrica* 18:155-162.
- Nash, J. F. 1953. *Two Person Cooperative Games*. *Econometrica* 21:128-140.
- Osborne, M. J. & Rubinstein, A. 1990. *Bargaining and Markets*. San Diego, Academic Press.
- Ostrom, E. 1990. *Governing the Common: The Evolution of Institutions for Collective Action*. New York, Cambridge University Press.
- Ostrom, E. 1994. *Constituting Social Capital and Collective Action*. *Journal of Theoretical Politics* 6:527-562.
- Ostrom, E. 1999. *Coping with Tragedies of the Commons*. *Annual Review of Political Science* 2:493-535.
- Ostrom, E., R. Gardner & J. Walker. 1994. *Rules, Games, & Common-Pool Resources*. Ann Arbor MI, The University of Michigan Press.
- Perez-Castillo, D. & D. Wettstein. 2001. *Bidding for the Surplus. A Non-Cooperative Approach to the Shapley Value*. *Journal of Economic Theory* 100:274-294.
- Rubinstein, A. 1982. *Perfect Equilibrium in a Bargaining Model*. *Econometrica* 50:97-109.
- Schelling, T. C. 1960. *The Strategy of Conflict*. London, Oxford University Press.
- Shogren, J. F., R. Moffett & M. Margolis. 2002. *Coasian bargaining with nonconvexities*. *Applied Economic Letters* 9:971-977.
- Shapley, L. 1953. *A Value for N-person Games*. *Annals of Mathematics Studies* XXVII:307-317
- Skyrms, B. 1996. *Evolution of the Social Contract*. Cambridge, Cambridge University Press.
- Skyrms, B. 2004. *The Stag Hunt and the Evolution of Social Structure*. Cambridge, Cambridge University Press.
- Sosis, R. 2002. *Comment to Alvard, M. S. & D. A. Nolin. Rousseau's Whale hunt?* *Current Anthropology* 43:553-554.
- Sosis, R, S Feldstein & K. Hill. 1998. *Bargaining Theory and Cooperative Fishing Participation on Ifaluk Atoll*. *Human Nature* 9:163-203
- Walker, J. M., Gardner, R., Herr, A. & Ostrom, E. 2000. *Collective Choice in the Commons: Experimental Results on Proposed Allocation Rules and Votes*. *The Economic Journal* 110:212-234.