



**AgEcon** SEARCH  
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

*The World's Largest Open Access Agricultural & Applied Economics Digital Library*

**This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.**

**Help ensure our sustainability.**

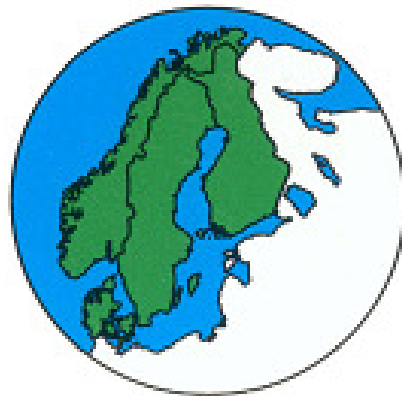
Give to AgEcon Search

AgEcon Search  
<http://ageconsearch.umn.edu>  
[aesearch@umn.edu](mailto:aesearch@umn.edu)

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

# **Scandinavian Forest Economics**

**No. 42, 2008**



**Proceedings  
of the Biennial Meeting of the  
Scandinavian Society of Forest Economics  
Lom, Norway, 6th-9th April 2008**

**Even Bergseng, Grethe Delbeck,  
Hans Fredrik Hoen (eds.)**

**Ås**

# First Movers, Non Movers and Social Gains from Supporting Entry in Markets for Nature-Based Recreational Goods

Suzanne Elizabeth Vedel, Jette Bredahl Jacobsen and Bo Jellesmark Thorsen

Forest & Landscape, University of Copenhagen  
Rolighedsvej 23, DK-1958 Frederiksberg C

## Abstract:

In general most nature-based recreational goods and benefits are considered positive externalities of production, as they are usually not subject to trade. So far, a low degree of rivalry among most user groups and legally defined rights has secured these benefits as almost a public good. Yet, the increasing intensity of use and the arrival of new demanding user groups are quickly changing the picture. In some regions, rivalry among user groups is strong, changing the situation to one of a common-pool resource and declining quality of the good. This provides an option for landowners to offer tailored goods and services to specific user groups, offering to improve the quality of their recreational experience against a payment.

Using a two-stage game theoretical model, we show that in spite of apparent potential first-mover advantages in this developing market, demand uncertainty and sunk costs may equally well result in widespread presence of non-movers on the supplier side. While most of the first-mover literature analyse the potentials for sustained first-mover gains, we focus on the presence of non-movers. In a simple model, we show that social gains can be made from offering a subsidy towards the sunk costs. The efficient scheme takes into account the underlying first-mover game.

**Key words:** First-mover advantage, game theory, sunk costs, demand uncertainty, fixed supply, public procurement, rationing.

## 1. Introduction

This paper explores the development of and entry into new markets for nature-based recreational goods by small private enterprises, and the condition for social gains to be made from supporting such development and entry.

The multiple benefits of nature as a resource for recreational and leisure activities have received increased attention and in many countries this use has been steadily on the rise for decades (Jensen and Koch, 1997). In many countries, well-defined and widespread access rights have meant

that the typical recreational goods enjoyed by users has essentially been an externality produced by forests and other nature areas, be they publicly or privately owned. Due to market failure the production of these externalities may be below the social optimum, and this may explain why some countries provide enhanced recreational access and goods on state owned land or implement less restrictive access rights in general. To the extent that these goods are non-excludable and non-subtractable, they can be characterized as public goods.

However, the continuous growth in outdoor recreation activities and in particular the recent decades' growth in still more demanding activities like mountain biking, snow-mobile riding and ATV-driving (Mantau et. al., 2001; Vail and Hultkrantz, 2000; Vail and Heldt, 2004), has left some recreational areas and services more of a common-pool resource than a public good. Also the increase in less demanding activities such as groups performing live-action role-play, people taking their dogs out and local sport/outdoor clubs are increasingly putting pressure on local forests and nature areas. The recreational experience enjoyed by hikers, bird-watchers and the like may be affected negatively by the activities of the more action-based user groups (Vail and Hultkrantz, 2000; Vail and Heldt, 2004), leading to conflicts and rivalry and in turn decreasing the value of the recreational experience for all user groups. In other areas, e.g. on privately owned land, such activities are not permitted or severely restricted. This development opens up the opportunity that private enterprises owning forests and other recreational areas develop tailored services for specific recreational user groups, offering them recreational access rights and experiences that are legal, of a higher quality than otherwise available and nevertheless does not impede on the rights of and benefits enjoyed by others.

As with all new markets, private enterprises may consider the option to enter the market early in order to obtain a first-mover advantage. First-mover advantages may in general be obtained and sustained for some time for several reasons, e.g. entering first may create buyer-switching costs, asymmetric information advantages and behavioural barriers which raise costs for followers (Lieberman & Montgomery, 1988; Kerin et. al., 2001). For the type of recreational facilities and services in focus here, it can be argued that first-mover advantages may in fact be present. Nevertheless, empirical evidence seems to suggest that the development of these markets appears to be slow and patchy (Mantau, et. al., 2001; 2001a).

A first question addressed in this paper is what may explain this lack of market development? There may be several explanations, including the possibility that private enterprises simply do not expect an entry to pay-off under any circumstances. However, given the apparent increase in nature-based recreational activities, this seems an unsatisfactory conclusion,

and we may benefit from considering other explanations. Therefore, in this paper we develop a model of the market entry decision, which includes standard first-mover advantages (Lieberman & Montgomery, 1988), but also other aspects which may explain why it may be optimal for the firms to wait. These aspects are the presence of irreversible sunk costs of entry, indivisibility of supply, demand uncertainty *a priori* and the option to obtain certain information on the demand state once a supply has been established.

We build these aspects into a two-player non-cooperative Bayesian simultaneous-move game in two stages with strategic interaction between the players (Mas-Colell et al., 1995). We derive the classic conditions for firms to pursue first-mover advantages, but we also show how in fact 'non-moving' may indeed be fairly widespread and agents essentially may very well sit and wait for information to come along before deciding on entry.

This observation gives rise to two additional questions: Can there be social gains from intervention and supporting the development of such markets? And if yes, then when and how such intervention could be best performed? These questions relate to the issue of public procurement of products and services. Public procurement is widespread, and obvious cases include public goods like defence or environmental goods, but also goods like health care and cultural goods. While public or state ownership or supply is sometimes feasible in this setting, e.g. public ownership of near-urban forest and nature areas and national parks, there are numerous cases where society finds it useful to secure a supply from private agents by creating incentive schemes for output of the good. Examples are the subsidies that are paid to landowners, who supply environmental goods, subsidies for dental care, health care etc.

We answer the questions raised here by determining conditions for which public procurement will be optimal, and the socially efficient procurement schemes maximising social benefits net of social costs, subject to agents reacting with supply.

The remainder of the paper is structured as follows. In section two we outline key characteristics of the recreational goods in focus here. We furthermore relate this to the theory on obtaining and sustaining first-mover advantages in new, developing markets, and we also outline the main issues addressed in the literature on public procurement and how our results relate to this. In section three we present the main parts of the model developed, and we use these to derive the results presented in section four. We discuss our results and the contribution they make in section five, where we indicate likely implications for policy design to follow from further analyses and of course highlight key limitations of the approach taken and results derived. In section six we make a few concluding remarks.

## 2. Theory

### 2.1 On the nature of nature-based recreational goods

The general classification of goods was influenced by Samuelson (1954) who first suggested subtractability or rivalry as the one attribute to divide all goods into either public or private goods by, with the latter group being goods where one person's consumption subtracts from the total consumption available. Musgrave (1959) challenged this and suggested that whether or not someone can be excluded from benefiting from the good should be used as attribute for dividing goods into public or private goods, with the latter being goods where exclusion is possible. They both aimed at creating a classification which could predict when markets would perform optimally and when they would fail. Later on, a combination of their classifications has been used where goods are classified into four types according to both rivalry and excludability (Ostrom 2003). Figure 1 presents the resulting classification.

	<b>Non-excludable</b>	<b>Excludable</b>
<b>Rivalry</b>	Common-pool resources	Private goods
<b>No rivalry</b>	Public goods	Club goods

Figure 1. Classification of goods (based on Ostrom (2003), Musgrave (1959) and Samuelson (1954))

The relevant access rights combined with the type of recreational use will be the major determinants for what type of good a given recreational good or services will be (according to figure 1), because it has implications for excludability as well as rivalry. Moreover, nature-based recreational goods often have characteristics which relate them to both services and manufactured goods which lead to different first-mover advantages. This has implication for the potentials for market development. An example: In Denmark, individual hiking is allowed on all forest land, and hence exclusion is not possible. Without rivalry, this is a public good. And indeed no marketed goods like access to hiking trails exist in Denmark. Horseback riding, however, is only allowed in some state-owned forests, not in private forests. Thus, exclusion is possible, and in fact a well-developed private market for individual or club-based horseback riding licences exist, the annual fee being in the range of 100-200 € (Lund et. al., 2008).

The degree of rivalry also has implications for the nature of recreational goods and in turn the potential for developing marketable goods and services. Increasing recreational use of nature areas, and in particular increases in intensive and demanding activities like ATV and snowmobile

riding as well mountain bike racing is causing rivalry among recreational user groups (Vail and Hultkrantz, 2000; Vail and Heldt, 2004; Lund et. al., 2008). This happens because of congestion and the presence of externalities related to use type; the consumption of one individual affects the consumption option of another. Rivalry makes the recreational good a common-pool resource. This may create an option for developing e.g. specialized trails for mountain bikers and other demanding user groups, which may be willing to pay for such improvements in their recreational experience.

The main challenge for the private enterprise in entering this market will often be to increase the level of excludability in order to make the good marketable. Mantau et. al. (2001a) investigated the emerging markets for recreational and environmental goods in several European countries and found that indeed a majority of the cases concerned goods related to recreation; concluding that the possibility to establish excludability is a key determinant (Merlo et. al., 2000). Ability to establish excludability makes it possible to market goods in the form of club or private goods. These studies also documented, however, that market development is very incomplete and patchy and varies greatly across regions. This may reflect the fact that most user groups are not willing to travel far (Jensen & Koch, 1997), and hence markets are likely to be quite regional in turn implying that potential suppliers may be few, and that information on demand can only be obtained locally, and hence remains uncertain until a supply is established (e.g. Chatterjee and Sugita, 1990). Furthermore, the supplier may not be able to vary the quantity supplied - half a mountain bike trail does not make much sense. Thus supply cannot be adjusted to the observed demand unless in fixed quantities. Finally, if entry implies sunk cost, e.g. for establishing recreational facilities, then this may further explain the sluggish development. These dis-incentives may be counterbalanced by the potential of entering first and enjoying first-mover advantages.

## ***2.2 First-mover advantages***

First-mover advantages refer to the benefits gained from pioneering in a field, e.g. by entering a new market, introducing a new product or a new process through innovation and R&D. Important early contributions have focused on the role of pioneering in establishing brands (Schmalensee 1982) or the role of first-mover advantages in halting or enhancing innovation (Reinganum 1981, 1983). Lieberman & Montgomery (1988) provided a unified framework and review of the research and concluded that first-mover advantages arise because of proficiency and luck. Theoretical models have confirmed that initial luck, skill-based or information asymmetries are prerequisites for gaining first-mover

advantages. The concept of barriers-to-entry may also explain first-mover advantages, defining a barrier to entry as “a cost of producing which must be borne by a firm which seeks to enter an industry but is not borne by firms already in the industry (Von Weizsacker, 1980, p.400). First-mover advantages are normally more complex to gain and sustain than simply enter the market first. In recent years first-mover advantages have been reviewed by Ketchen et. al. (2004) as one research stream within competitive dynamics and Kerin et. al. (2001) have broadened the conceptual framework on first-mover advantages by analysing which mechanisms underlie these advantages and what factors have an enhancing or diminishing effect on the basic mechanisms. The mechanisms to gain and sustain first-mover advantages may be several, but here we discuss some key factors relevant for the development of markets for nature-based recreational goods.

Costs of entry are widely believed and found to be lower in service markets as compared to markets for manufactured goods (Song et. al., 1999) and services are often easier to copy than manufactured goods. These differences make it harder for a pioneer in services to gain and sustain a first-mover advantage compared to a manufactured good innovator. Moreover, due to the heterogenic characteristics of services it is easier for a later entrant to offer a slightly differentiated service directed at specific customer needs (Song et. al., 1999, 2000). Many potential recreational goods may very well resemble services in the sense that they are easily copied and that very little asymmetric information on product content can be established by the pioneer. On the other hand, if the recreational service supplied takes the form of an up-front investment in a recreational facility offered on a contract basis to user groups, then another type of mechanism may create and sustain first-mover advantages. This includes buyer switching costs, the possibility of affecting preferences, communication good effects and information and consumption experience asymmetries.

Buyer switching costs may arise quite strongly if the first-mover in some way manages to tie the buyers economically through a contract or through the buyers investing themselves in e.g. facilities established jointly with the first-mover agent. Thus, sunk costs on behalf of the buyers will make it more expensive for the follower to enter and compete with the first-mover. More standard buyer switching costs include the ‘search and learning costs’, which the buyer will have to sustain in order to investigate alternative services. Furthermore, the first-mover may also affect people’s preferences by setting a standard, where new products and recreational goods marketed later will be compared to the first goods and its characteristics (Kerin et. al., 1992), and may be judged and valued according to the perceived ‘ideal’ combination of attributes (Chiang, 2004; Brekke, 1997). Buyer switching costs may be more important for



recreational services that are partly intangible as their quality cannot be inspected by the user before purchase (Bharadwaj et. al., 1993).

A communication good effect may also arise for certain types of recreational goods if their value for the individual users increases as the number of users increase – at least to some level. An example is facilities directed towards social interaction among users, like mountain bike trails or role-play facilities. Users will be less willing to move their recreational activity to a new and less used facility, potentially creating the first-mover advantages (Carpenter & Nakamoto, 1989; Bahradwaj et. al., 1993).

### ***2.3 Public procurement of environmental goods***

States and their public bodies ensure the provision of many goods. True public goods like defence and police are usually provided by public production, but often the production of goods, public or other, is delegated to private agents and the role of the public body becomes one of creating incentives for reaching the socially optimal supply. Such incentives often take the form of subsidies as when private landowners are partially compensated to supply environmental goods, or when general practitioners or dentists are subsidised to provide cheap health care.

How to undertake such public procurement efficiently have been analysed in numerous studies and with different approaches over the years. Since the seminal work of Akerlof (1970) such procurement problems have routinely been modelled as principal-agent problems, and the agency framework is now textbook material (e.g. Bolton and Dewatripont, 2005). Examples of applications concerning environmental services from agriculture and forestry include e.g. Hart and Latacz-Lohmann (2005), Anthon and Thorsen (2004) and Vedel et. al. (2006). Also auction theory (see Klemperer, 1999) has been investigated for public procurement schemes in this field, e.g. Latacz-Lohmann and Hamsvoort, (1997; 1998).

The analysis of this paper does not concern itself with asymmetric information, but it does concern itself with forthcoming information on market states, and is in that way related to Chatterjee and Sugita (1990). Furthermore, it concerns itself with the effects of fixed costs of production, here entry costs, and its role not only for the agents' entry decision, but also for the optimal design of procurement schemes over time. The role of fixed costs in procurement schemes have been investigated e.g., by Anthon et. al. (2007a, 2007b), who found rationing to be an optimal instrument for the social planner. The model of this paper differs in several ways, one of them being that it involves time dynamics and the revelation of forthcoming information. We point out that further analyses may identify circumstances where rationing is nevertheless optimal for the social planner.

### 3. Models

#### 3.1 The entering game

The decision problem of whether to enter a new market or wait is modelled by a non-cooperative Bayesian simultaneous-move game in two stages with strategic interaction between the players (Mas-Colell et. al., 1995).

We consider a simple model with only two agents,  $i \in \{A; B\}$ , and to begin we assume the agents are identical. The agents have the option to enter the new market by establishing and operating a new recreational facility to offer possible customers an improved recreational experience. However, each of them can at any time  $t$  only offer the good in fixed quantities  $q_{it} \in \{0; q_{Ai}; q_{Bi}\}$  and only after having incurred an initial investment cost which is  $I_i$  for the firm that enters the new market and  $bI_i$ , with  $b > 1$  for the firm that waits and enters the market second. Once the facility is established the agents may operate it at a cost  $c$  proportional to the supply  $q_{it}$ , and sell the improved recreational experience on the market at a price,  $p(Q_i; D^j)$ , which depend on the aggregate supply across the agents  $Q_i = \sum q_{it}$  as well as the state  $j$  of demand  $D^j$ . As the market is new, demand is unknown to the agents, but they do hold expectations concerning its size. More specifically they expect demand to be low, medium or high,  $D^j \in \{D^L; D^M; D^H\}$  with probabilities  $l, m$  and  $h = 1-l-m$ . We assume that once an agent has entered the market, the state of demand,  $D^j$ , becomes immediately known to him, and furthermore becomes common knowledge after some time lapse,  $T$ . The discount rate is  $r$ .

Furthermore, the relation between demand, aggregate supply and profitability of establishing and running the facility is known by both agents to be:

- if demand turns out to be low it cannot sustain even one profitable project
- if demand turns out to be medium it can sustain only one project profitably – if both agents enter their overall returns will be negative
- if demand is high, both projects will be profitable

Thus, for a firm that decides to enter the market at first chance,  $t = 0$ , the expected present value,  $V$ , of the project is:

$$V(q_{it} | enter_{i0}) = -I_i + E \left( \int_{t=0}^T e^{-rt} [p(Q_i; D^j) - c] q_{it} dt \right) + \frac{e^{-rT}}{r} E([p(Q_i; D^j) - c] q_{it}). \quad (1)$$

Where the expectations operator,  $E$ , concerns the demand state,  $D^j$ . Note that here the entry decision is still assumed unconditional and hence the maximization concern the decision whether or not to operate, i.e. whether  $q_{it}$  is 0 or not. This decision is conditional on the observed demand as well as on aggregate supply,  $Q_t$ , and hence the choice of the opponent. Note that if both firms enter immediately,  $T = 0$ . Also, any change in  $Q_t$  for  $t > T > 0$  will be due to the possible entrance of a competitor. Similarly, for the firm that decides to wait and enter only when demand is revealed to be high at time  $T$ , the expected present value at  $t = 0$  is:

$$\begin{aligned} V(q_{it} | enter_{it}) &= E\left(-e^{-rt} bI_i + \frac{e^{-rT}}{r} [p(Q_t; D^H) - c] q_{it}\right) \\ &= h \times \left(-e^{-rT} bI_i + \frac{e^{-rT}}{r} [p(Q_t; D^H) - c] q_{it}\right) \end{aligned} \quad (2)$$

Here the expectations operator concerns only the probability,  $h$ , that demand is high. Note that since the agent here needs to enter second he incurs a higher investment cost reflected in the factor  $b$ .

The equations (1) and (2) reveal that this problem is essentially a two period problem. One period prior to the market state becoming common knowledge and one period post revelation. Define the per period revenue function as  $E(R_{it}^j(q_{it}; Q_t, D^j)) = E([p(Q_t, D^j) - c] q_{it})$ . Furthermore, let:

$$\begin{aligned} K_1(T) &= \int_{t=0}^T e^{-rt} dt = \left(\frac{1 - e^{-rT}}{r}\right) \\ K_2(T) &= \int_{t=T}^{\infty} e^{-rt} dt = \frac{e^{-rT}}{r}. \end{aligned} \quad (3)$$

Suppressing the arguments of the functions, this allows us to rewrite equations (1) and (2) into:

$$V(q_{it} | enter_{i0}) = -I_{i0} + K_1(T) \times E(R_{i1}^j(Q_1, D^j)) + K_2(T) \times E(R_{i2}^j(Q_2, D^j)) \quad (4)$$

$$V(q_{it} | enter_{iT}) = h \times K_2(T) (-rbI_{iT} + R_{i2}^H(Q_2 | D^H)) \quad (5)$$

The equations clearly illustrate the dilemma, which drives the game to be analysed: Will the potential benefits of waiting, which essentially is the value of knowing the market state before investing, outweigh the potential benefits of entering quickly and maybe get a period of length  $T$  alone?

The dilemma is amplified by the fact that we assume the game to be a non-cooperative Bayesian simultaneous-move game, implying that the

decision needs to be taken at each stage without knowing the opponent's decision at that stage. The pay-offs of each decision at each stage conditional on demand state and the opponent's decision are shown in a series of tables in the appendix. The results of the game theoretic analysis of this dilemma are presented in the next section, but before turning to them, we present the problem of the social planner.

### 3.2 The public procurement problem

As explained above public procurement is usually directed towards the procurement of goods of a more or less public good nature. However, public subsidies for certain activities can also be socially optimal, e.g. dental expenses are in many countries at least partly subsidised and even private companies may obtain public support for risky innovation and R&D efforts if they would not otherwise be undertaken and is deemed of public interest. This latter case is the one most related to the case we investigate here.

The public procurement will only be relevant if no firms enter the market, and the social planner sees a welfare gain to be made from offering agents a subsidy large enough to have at least one of them entering the market. We model the subsidy as a one-time payment to the agent as an incentive to undertake the initial investment  $I_{it}$ . Given the above model for the private agents, the objective of the social planner is to choose the subsidy scheme,  $s_{it} \in \{0; s_{AO}; s_{BO}; s_{AT}; s_{BT}\}$  (a contract defined by  $\{s_{it}, q_i\}$ ) that maximizes social welfare. We let benefits be the integral of the demand schedule over  $Q$ , and subtract social costs:

$$\begin{aligned}
 W(s_{it}; Q_t, D^j) = & \max_{s_{it}} K_1(T) E \left( \int_{Q=0}^{Q_1} D^j(Q) dQ - cQ_1 \right) - \sum_{i=A}^B I_{i0} - \beta \sum_{i=A}^B s_{i0} \\
 & + K_2(T) E \left( \int_{Q=0}^{Q_2} D^j(Q) dQ - cQ_2 \right) - rK_2(T) E \left( [bI_{iT} + \beta s_{iT}] | D^j, s_{i0} \right)
 \end{aligned}
 \tag{6}$$

We note that the subsidy is only a transfer and thus is not a social cost. However, public funds for such a transfer are usually financed by taxes and the social costs of levying such taxes are captured in the factor  $\beta$ . In Denmark, e.g. the Ministry of Finance assess that  $\beta = 0.2$ . We may separate the expected periodical consumer surplus,  $E(CS(Q_t, D^j))$  (as a Marshallian measure) from the expected periodical producer surplus,  $E(PS(Q_t, D^j)) = [P(Q_t, D^j) - c] Q_t$  when the investment has been established. This leads to (6) revised as:

$$\begin{aligned}
W(s_{it}; Q_t, D^j) = & \max_{s_{it}} K_1(T) [E(CS(Q_1, D^j)) + E(PS(Q_1, D^j))] \\
& - \sum_{i=A}^B I_{i0} - \beta \sum_{i=A}^B s_{i0} + K_2(T) E[E(CS(Q_2, D^j)) + E(PS(Q_2, D^j))] \\
& - rK_2(T) E([bI_{iT} + \beta s_{iT}] | D^j, s_{i0})
\end{aligned} \tag{7}$$

We assume that once decided upon, the social planner will announce and commit to the chosen plan for  $s_{it} \in \{0; s_{A0}; s_{B0}; s_{AT}; s_{BT}\}$ . Thus, no private information exist either concerning the actions of the social planner and hence the agents will simultaneously evaluate the offers made contingent on the declared plan for provisions of subsidies (contracts) and the resolution of the two-stage non-cooperative Bayesian simultaneous-move game.

## 4. Results

### 4.1 Analysing first-mover advantages with identical agents

In Appendix 1 we have shown all the possible pay-offs for the agents, dependent on the three possible states of demand as well as the opponent's strategy. The overall expected return of any combination of strategies is the probability weighted sum of the returns from the three possible states of demand, cf. also (4) and (5). To save notation in the following, we denote the expected return conditional on the opponent's decision as  $\pi(\text{decision}_A | \text{decision}_B)$ .

One can prove that the non-cooperative Bayesian simultaneous-move game has the following possible Nash Equilibriums (NE), depending on the parameters of the problem.

*Proposition 1:* Both entering at  $t = 0$  will be the only NE iff  $\pi(\text{Enter}_A | \text{Enter}_B) > \pi(\text{Wait}_A | \text{Enter}_B)$ .

*Proposition 2:* Both waiting forever will be the only NE iff  $0 > \pi(\text{Enter}_A | \text{Wait}_B)$ .

*Proposition 3:* The mixed equilibriums,  $\pi(\text{Wait}_A | \text{Enter}_B)$  and  $\pi(\text{Enter}_A | \text{Wait}_B)$ , will both be NE if  $\pi(\text{Enter}_A | \text{Wait}_B) > 0$  and  $\pi(\text{Wait}_A | \text{Enter}_B) > \pi(\text{Enter}_A | \text{Enter}_B)$ .

We will not elaborate on the proofs here, but note that they make use of the fact that given the above model and assumptions we have  $\pi(\text{Wait}_A | \text{Enter}_B) > 0$  and  $\pi(\text{Enter}_A | \text{Wait}_B) > \pi(\text{Enter}_A | \text{Enter}_B)$ . The general pattern of results is well-known for this type of games and is also found in e.g. Chatterjee and Sugita (1990). The models are different, and therefore

also the exact parameters determining, which of the equilibriums is the relevant one.

Much of the literature on first-mover advantages has focused on what factors drive the value of the first-mover advantages and how they may be sustained, i.e. basically the NE's associated with the first and the last of the above three sets. Very little attention, however, has been given to the second possible NE, the scenario where none of the agents will be willing to move into the new market as the expected returns are negative. This scenario may be very likely in cases where entering implies relatively large up-front costs and the agents also face significant uncertainty regarding returns to investment, including potentially fast erosion of any first mover advantages. However, this scenario may be interesting from a social planner's point of view. It may be that even if entering the new market is not profitable for the private agent, the society at large may reap an overall welfare gain if the agent can be persuaded to enter. The conditions for this and the optimal design of persuading incentives are investigated next.

#### ***4.2 Solving for efficient public procurement***

With only two agents and essentially only two periods, the social planner faces a double question: How many agents does she need to offer a subsidy contract against the agent undertaking the investment  $I_i$ ? And how small a subsidy is needed to bring about the optimal overall supply of the good? Because of the sequential game nature of the problem we analyse here, these two questions can only be resolved simultaneously. Given the set-up here with a two stage problem with two agents being able to supply only a fixed discrete quantity each, the social planner need not concern herself with how much she wants the individual agent to supply. It is either  $q_{it}$  or nothing. She only has to consider how many of the agents to subsidise, when and how much. Regarding the first two questions, there are four possible decisions<sup>32</sup> embedded in (7) concerning the number of subsidies:

- X: Only one subsidy is ever offered, and by the problem's construction this is offered at the beginning of period 1.
- Y: The social planner offers a subsidy to both agents simultaneously, and by the problem's construction this is offered at the beginning of period 1.
- Z: The social planner offers one subsidy in period 1, and only offers a subsidy in period 2, if the revealed demand suggests that there is a welfare economic gain to be made from improving it.

---

<sup>32</sup> Apart from the obvious and uninteresting case of not offering any contracts.

The latter question of ‘how much’ to offer each agent in the contract, is resolved by the maximization in (7) combined with the participation constraint implied by (1) and (2) modified with the subsidy offered in the contract. This allows us to evaluate the optimal level of  $s_{it}$  in each of the four possible decisions and subsequently determine under which conditions, the different decisions may be optimal.

In Case X, when only one subsidy is offered, the constrained version of (7) is:

$$W(s_{i0}; Q_t, D^j) = \max_{s_{it}} K_1(T) [E(CS(q_{i1}, D^j)) + E(PS(q_{i1}, D^j))] - I_{i0} - \beta s_{i0} + K_2(T) [E(CS(Q_2, D^j)) + E(PS(Q_2, D^j))] - hrK_2(T) bI_{iT} \quad (8)$$

This reflects that only one agent will enter in period 1, and that the second agent will only enter in period 2 if the state of demand is high, which happens with probability  $h$ . To have an agent accept the contract offered, it must fulfil the incentive constraint:

$$V(q_{i1} | enter_{i0}) = -I_{i0} + K_1(T) \times E(R_{i1}^j(q_{i1}, D^j)) + K_2(T) \times E(R_{i2}^j(Q_2 | D^j)) + s_{i0} = -I_{i0} + K_1(T) \times E(R_{i1}^j(q_{i1}, D^j)) + K_2(T) \times (h \times R_{i2}^H(Q_2 | D^H) + m \times R_{i2}^M(q_{i2} | D^M) + l \times R_{i2}^L(q_{i2} | D^L)) + s_{i0} \geq 0 \quad (9)$$

That is, the subsidy must be large enough to at least keep the agent indifferent to entering or not. Note that the second stage term takes into account that the agent will be alone in period 1, but also potential entering of the second agent in period 2 (with probability  $h$ ). This is reflected in the supply expected in the two periods. By the maximization in (8) it is straightforward that (9) will be a binding constraint.

For the case Y where the social planner offers both agents a contract simultaneously, the corresponding version of (7) is:

$$W(s_{i0}; Q_t, D^j) = \max_{s_{i1}} (K_1(T) + K_2(T)) [E(CS(Q, D^j)) + E(PS(Q, D^j))] - \sum_{i=A}^B I_{i0} - \beta \sum_{i=A}^B s_{i0} \quad (10)$$

This reflects that given subsidies, the quantity supplied will be constant and at maximum from the beginning. This also affects the subsidy needed, as it implies that none of the agents will enjoy a period alone on the market and that no matter what the state of the market is revealed to be, supply will be large and hence returns will be low. The incentive constraint becomes:

$$\begin{aligned}
V(q_{i1} | enter_{i0}) &= -I_{i0} + r^{-1} \times E(R_i^j(Q | D^j)) + s_{i0} = \\
&- I_{i0} + r^{-1} \times [l \times R_i^L(Q | D^L) + m \times R_i^M(Q | D^M) + h \times R_i^H(Q | D^H)] + s_{i0} \geq 0 \quad (11)
\end{aligned}$$

It can be shown that the social planner in this case has to offer a larger subsidy than in the X-case, i.e. that (11)>(9). Whether it is, nevertheless, socially optimal to start both agents of right away depends on the welfare gain  $W$  in (10) relative to  $W$  of (8).

The final case we investigate, Z, is the one, where the social planner may consider offering a subsidy at time  $T$  too, i.e. once the state of demand is known. Note that we have assumed all along that the second agent will for sure enter if demand is high, and that at low demand market based income cannot even cover the costs of one agent. This leads to the logic conclusion that the social planner can only find it optimal to subsidise the second agent in case of a medium demand. Thus, the social welfare maximization problem becomes:

$$\begin{aligned}
W(s_{it}; Q_t, D^j) &= \\
\max_{s_{it}} K_1(T) [E(CS(q_{i1}, D^j)) + E(PS(q_{i1}, D^j))] &- I_{i0} - \beta s_{i0} \\
+ K_2(T) [E(CS(Q_2, D^j)) + E(PS(Q_2, D^j))] & \\
- r K_2(T) [m(bI_{iT} + \beta s_{iT}) + hbI_{iT}] & \quad (12)
\end{aligned}$$

This is maximised by setting the smallest set of subsidies that satisfy the incentive constraints. For the first agent in stage 1, it needs to satisfy:

$$\begin{aligned}
V(q_{i1} | enter_{i0}) &= -I_{i0} + K_1(T) \times E(R_{i1}^j(q_{i1}, D^j)) + s_{i0} + \\
K_2(T) \times (h \times R_{i2}^H(Q_2 | D^H) + m \times R_{i2}^M(Q_2 | D^M) + l \times R_{i2}^L(q_{i2} | D^L)) &\geq 0 \\
(13)
\end{aligned}$$

Where the expectation concerning period two now includes both the probability that demand will be high and the second agent enter fore sure, and that demand will be medium and the second agent enter with a subsidy from the social planner. That subsidy will have to satisfy:

$$\begin{aligned}
V(q_{i2} | enter_{iT}) &= \\
- I_{iT} + r^{-1} \times (m \times R_{i2}^M(Q_2 | D^M) + h \times R_{i2}^H(Q_2 | D^H)) &+ s_{iT} \geq 0 \quad (14)
\end{aligned}$$



Which of the three subsidy schemes is the better, will not be developed further here. It will be determined by the size of  $W$  and the best size of subsidy by  $V$ . Thus the underlying first-mover game will play an important part in the social optimal subsidy scheme. Nevertheless, the results arrived at so far indicates that under some circumstances, it may be optimal to subsidize both agents immediately, e.g. to avoid a long period of low supply and that under other circumstances it will be optimal to ration subsidies over time to benefit from forthcoming information and hence offer only one subsidy first and only a second one if demand is favourable for this, but not high enough to secure entry of the second agent.

## 5. Discussion

Increasing rivalry in the use of nature areas for recreation implies that the forest as a site for recreational activity resemble more and more a common-pool good rather than a public good. At the same time, recreational activities have become more specialised and demanding, creating the possibilities for landowners to supply something extra in terms of facilities and services, which may allow for some degree of exclusion and hence marketability. This may be desirable from a socio-economic perspective because goods and services, which would not otherwise be supplied may suddenly be, maybe at the same time reducing rivalry for remaining nature areas. The entry into any market may be associated with first-mover advantages as well as risk and uncertainty. We argue that this may also be the case here.

The focal point in the literature on first-mover advantages has been gaining and sustaining first-mover advantages in emerging markets. In relation to nature-based recreational goods and services the development of new markets seems slow and patchy despite increasing demand from various user groups and potential first-mover advantages in this market.

Based on the special characteristics of nature-based recreational goods and services, we develop a model which encompasses the main problems: potentially high sunk costs, fixed supply, strategic interaction between a few agents in the potential market and uncertainty about the demand in the market. The model shows that in a case with no private information and identical agents all outcomes can be supported as NE of the Bayesian game, and thus situations of non-movers is possible depending on the relative importance of the different parameters. Specifically non-movers may be induced by a relatively large uncertainty of demand, resulting in advantages by letting others reveal the market. This value of waiting is well analysed in the real option literature (McDonald and Siegel, 1986) and has also been shown to affect policy measures like subsidies for entry (Thorsen, 1999), but what is important here is its relative size compared to the potential first-mover advantage.

However, the similarity between firms also rules out any scope for earning excess profits. As previously found in literature on first-mover advantages the possibility of excess profit will be ruled out because of competition when firms are identical (Liebermann & Montgomery, 1988). Whereas most analyses focus on the situations where one agent gains first-mover advantages for a shorter or longer while, we have focused on the situation of non-movers and possible scenarios of public procurement of nature-based recreational goods.

In a situation where a market does not develop by itself it may be relevant for a social planner to subsidise the market in the beginning in order to reveal the state of demand and promote market development. We calculate the expected welfare gains for a social planner under three different scenarios and derive the agents' participation constraints. The social planner can choose one of three scenarios: subsidise one agent at the beginning of period one, subsidise both agents at the beginning of period one or sequential rationing by subsidising one agent in period one and one agent in period two. Which subsidy strategy will be optimal for the social planner requires a deeper analysis which we have not dealt with in this paper but left for further work, but we expect to be able to identify under which circumstances, it may be optimal to subsidise both agents immediately and under which it will be optimal to ration subsidies over time to benefit from forthcoming information.

In the present model we have made several simplifying assumptions and one of the bolder one is that of identical agents. Further analyses should also look into the effect of differences among agents, e.g. what will be the effect of differences in the fixed quantity with which an agent will enter, what will be the effect of agent-specific differences in  $T$ , i.e. ability to cover-up information on the market state post-entry. Furthermore, while the sunk costs are quite essential and realistic for the model, we conjecture that we can relax the assumption of the agents' having a fully fixed supply post investment. A more realistic assumption would be that they may have a fixed maximum supply due to capacity constraints, but can in fact decide freely on their supply within this capacity. This would allow for improved monopoly rents for a first-mover and increase the social planner's incentive to support competitors' entry prior to market revelation.

## 6. Concluding Remarks

In this paper we have addressed the issue of first-movers, non-movers and social gains from developing a new market for nature-based recreational goods. We have addressed two main questions: i) Why is there a lack of market development? ii) Can there be social gains from intervention and supporting the development of such markets? and

addressed more briefly iii) if so, then when and how should such intervention be performed best?

In order to answer the first question, we use a two-stage non-cooperative Bayesian simultaneous-move game model, and show that in spite of apparent potential first-mover advantages in this developing market, demand uncertainty and sunk costs may equally well result in widespread presence of non-movers on the supplier side. While most of the first-mover literature analyse the potentials for sustained first-mover gains, we have focused on the presence of non-movers.

Using a simple model, we answer the second question by showing that social gains can be made from offering a subsidy towards the sunk costs. Social gains may be made even in cases where a first-mover has already established it self. The third question, when and how such intervention should be done, is briefly illustrated by three subsidy schemes, i) only one subsidy is offered ever, ii) two subsidies are offered simultaneously, iii) one subsidy is offered and if revealed demand shows a welfare economic gain of offering another, this is done. Which of them is preferable will depend on revealed demand and the underlying first-mover game. This we will develop further in future work.

## **References:**

- Akerlof, G., 1970. The market for 'Lemons': qualitative uncertainty and the market mechanism. *Quarterly journal of Economics* 89, 488-500.
- Anthon, S. and Thorsen, B. J., 2004. Optimal afforestation contracts with asymmetric information on private environmental benefits. Working paper no. 46 in The Fondazione Eni Enrico Mattei Series, Italy, 35 pp.
- Anthon, S., P. Bogetoft and B.J. Thorsen, 2007a: A Bureaucrat's Procurement Strategy: Budget Constraints and Rationing, *Annals of Public and Cooperative Economics*, 78, 221-244.
- Anthon, S., P. Bogetoft and B.J. Thorsen, 2007b: Socially Optimal Procurement with Tight Budgets and Rationing, *Journal of Public Economics*, 91: 1625-1642
- Bharadwaj, S. G., Varadarajan, P. R. and Fahy, J., 1993. Sustainable competitive advantage in service industries: A conceptual model and research propositions, *Journal of Marketing*, 57(4), 83-99.
- Bolton, P. and Dewatripont, M., 2005. *Contract theory*, Cambridge, MA: MIT press.
- Brekke, K. A. 1997. *Economic growth and the environment: On the measurement of income and welfare*, Cheltenham, Edward Elgar.

- Chatterjee R. and Y. Sugita 1990. New product introduction under demand uncertainty in competitive industries. *Managerial and Decision Economics*, vol. 11, 1-12.
- Chiang, K. 2004. A consumer preference formation perspective on pioneering advantage in electronic marketplace. *Advances in Consumer Research*, vol. 31, 382-386.
- Hart, R. and Latacz-Lohmann, 2005. Combating moral hazard in agri-environmental schemes: a multiple-agent approach. *European Review of Agricultural Economics*, vol. 32, 1, 75-91.
- Jensen, F. S. and Koch, N. E., 1997. *Friluftsliv i skovene 1976/77-1993/94* ("Recreation in Danish Forests from 1976/77 to 1993/94"). Forskningsserien nr. 20, Forskningscentret for Skov & Landskab, Hørsholm.
- Kerin, R. A., Varadarajan, P. R. and R. A. Peterson 2001. First-mover advantage: A synthesis, conceptual framework and research propositions. *Journal of Marketing*, vol. 56, 33-52.
- Ketchen, D. J. Jr., Snow, C. C. and V. L. Hoover 2004. Research on competitive dynamics: Recent accomplishments and future challenges. *Journal of Management*, 30(6), 779-804.
- Klemperer P., 1999. Auction theory. A guide to the literature. *Journal of economic surveys* 13, 227-286.
- Latacz-Lohmann U. and Van der Hamsvoort, C. P. C. M., 1997. Auctioning conservation contracts: a theoretical analysis and an application. *American Journal of Agricultural Economics*, 79, 407-418.
- Latacz-Lohmann U. and Van der Hamsvoort, C. P. C. M., 1998. Auctions as a means for public goods from agriculture. *Journal of Agricultural Economics*, 49, 334-345.
- Lieberman, M. B. & D. B. Montgomery 1988. First-mover Advantages. *Strategic Management Journal*, vol. 9, Special issue: Strategy content research, 41-58.
- Lund, J. F., Thorsen, B. J., Kaae, B. C., Vedel, S. E., Lyck, L. and Broch, S. W., 2008. *Produktudvikling i skovene – et idéhæfte*. ("Product development and innovation in Forests – a concept folder"). Forest & Landscape, University of Copenhagen.
- McDonald, R. and Siegel, D. 1986. The Value of Waiting to Invest. *The Quarterly Journal of Economics* 101, 707-727.
- Mantau, U., Merlo, M., Sekot, W. and B. Welcker 2001. *Recreational and Environmental Markets for Forest Enterprises*, CAB International, UK.
- Mantau, U., Mertens, B., Welcker, B. and B. Malzburg 2001a. Risks and chances to market recreational and environmental goods and services – experience from 100 case studies. *Forest Policy and Economics* 3, 45-53.

- Mas-Colell, A., Whinston, M. and J. R. Green 1995. *Microeconomic Theory*, Oxford University Press, New York.
- Merlo, M., Milocco, E., Panting, R. and P. Virgilietti 2000. Transformation of environmental recreational goods and services provided by forestry into recreational environmental products. *Forest Policy and Economics* 1, 127-138.
- Musgrave, R. A. 1959. *The theory of public finance*, McGraw-Hill, New York.
- Ostrom, E. 2003. How types of goods and property rights jointly affect collective action. *Journal of theoretical politics* 15(3), 239-270.
- Reinganum, J.F., 1981: Dynamic Games of Innovation. *Journal of Economic Theory*, 25, 21-41.
- Reinganum, J.F., 1983: Uncertain Innovation and the Persistence of Monopoly. *American Economic Review*, 73, 741-748.
- Samuelson, P. A. 1954. The pure theory of public expenditure, *Review of Economics and Statistics* 36 (nov), 387-389.
- Schmalensee, R., 1982: Product Differentiation Advantages of Pioneering Brands. *American Economic Review*, 72, 159-180.
- Song, X. M., Di Benedetto, C. A. and Y. L. Zhao 1999. Pioneering advantages in manufacturing and service industries: empirical evidence from nine countries, *Strategic Management Journal* 20, 811-836.
- Song, X. M., Di Benedetto, C. A. and L. Z. Song 2000. Pioneering advantage in new service development: A multi-country study of managerial perceptions, *Journal of Product Innovation Management* 17, 378-392.
- Thorsen, B.J., 1999. Afforestation as a real option: Some policy implications. *Forest Science*, 45, 171-178.
- Vail, D. and Heldt, T., 2004. Governing snowmobilers in multiple-use landscapes: Swedish and Maine (USA) cases. *Ecological Economics* 48, 469-483.
- Vail, D. and Hultkrantz, L., 2000. Property rights and sustainable nature tourism: adaption and mal-adaption in Dalarna (Sweden) and Maine (USA). *Ecological Economics* 35, 223-242.
- Vedel, S. E., Lund D. H., Jacobsen J. B. and Helles, F., 2006. Grants for advisory services in the private Danish forestry sector - A principal-agent approach. *Journal of Forest Economics* 12, 185-199.
- Von Weizsacker, C. C. 1980. A welfare analysis of barriers to entry, *Bell Journal of economics*, 11 (Autumn), 399-420.

## Appendix 1

### Pay-offs conditional on opponent behaviour and *high* state of demand

A \ B	B waits at $t = 0$	B enters at $t = 0$
A waits at $t = 0$	0, 0	$K_2(-rbI_{iT} + R_{A2}^H(Q)),$ $-I_{B0} + K_1R_{B1}^H(q_{B1}) + K_2R_{B2}^H(Q)$
A enters at $t = 0$	$-I_{A0} + K_1R_{A1}^H(q_{A1}) + K_2R_{A2}^H(Q),$ $K_2(-rbI_{iT} + R_{B2}^H(Q))$	$-I_{i0} + r^{-1}R_i^H(Q)$

### Pay-offs conditional on opponent behaviour and *medium* state of demand

A \ B	B waits at $t = 0$	B enters at $t = 0$
A waits at $t = 0$	0, 0	$0, -I_{B0} + K_1R_{B1}^M(q_{B1}) + K_2R_{B2}^M(q_{B1})$
A enters at $t = 0$	$-I_{A0} + K_1R_{A1}^M(q_{A1}) + K_2R_{A2}^M(q_{A1}), 0$	$-I_i + r^{-1}R_i^M(Q)$

### Pay-offs conditional on opponent behaviour and *low* state of demand

A \ B	B waits at $t = 0$	B enters at $t = 0$
A waits at $t = 0$	0, 0	$0, -I_{B0} + K_1R_{B1}^L(q_{B1}) + K_2R_{B2}^L(q_{B1})$
A enters at $t = 0$	$-I_{A0} + K_1R_{A1}^L(q_{A1}) + K_2R_{A2}^L(q_{A1}), 0$	$-I_i + r^{-1}R_i^L(Q)$