University of Alberta

The Impact of Social Context on Conservation Auctions:
Social Capital, Leadership and Crowding Out

by

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A thesis submitted to the Faculty of Graduate Studies and Research
in partial fulfillment of the requirements for the degree of

Doctor of Philosophy
in
Agricultural and Resource Economics

Department of Resource Economics & Environmental Sociology

Fall 2011
Edmonton, Alberta

Your file Votre référence
ISBN: 978-0-494-89244-2

Our file Notre référence
ISBN: 978-0-494-89244-2

Abstract

Conservation auctions are a policy tool that can be used to cost-effectively achieve environmental goals, by providing incentives for landowners to adopt environmentally friendly beneficial management practices (BMPs) on their land. Using a competitive bidding process, the party interested in encouraging BMP adoption selects and enters into contract with landowners, who receive monetary compensation in return for their adoption of the new practices.

Previous research on conservation auctions has focused mainly on various design choices which can impact auction performance. This study takes a different approach, examining the influence of the social context in which auctions take place.

Real auctions may be implemented in communities with varying levels of social capital and leadership. Since these factors have been shown to influence individual behaviour in a variety of settings, we hypothesize that they may also influence bidder behaviour within a conservation auction and, in turn, the cost-effectiveness and environmental outcomes of the auction. Using simulated auctions in an experimental setting, we sort participants into experimental treatments based on social capital and leadership characteristics. We find that both social capital and leadership do indeed have multi-dimensional, context-specific effects on bidder behaviour and auction outcomes.

In addition, real auctions may take place in communities where some landowners have already adopted BMPs, driven by pro-social or pro-

environmental "internal" motivations. Previous research has found that such motivations may be crowded out by the introduction of "external" motivations such as fines or regulation. We show, using an experimental approach, that conservation auctions also appear to cause crowding out of voluntary pro-environmental behaviour.

This research contributes to the academic literature by linking theories of social capital and leadership to the literature on conservation auctions, and extending the literature on crowding out to this specific policy mechanism. In addition, it provides an innovative way of investigating the influence of social factors within an experimental setting. There are also important policy implications, as our findings draw attention to the importance of considering social context when designing and implementing conservation auctions.

Acknowledgements

Financial support for the research described in this thesis was provided by the Alberta Water Research Institute, the Watershed Evaluation of Beneficial Management Practices project, Agriculture and Agri-Food Canada, and the Social Sciences and Humanities Research Council of Canada. Dr. Vic Adamowicz and Dr. Peter Boxall provided much guidance and support in planning, designing and analyzing the research. My fellow experimentalists Stephanie Simpson, Katherine Packman, Orsolya Perger, and Dana Harper were always ready to offer advice, help and commiseration. Thanks to all the Rural Economy (now REES) staff for all your support throughout my graduate program. Finally, a huge thank you to my wonderful, supportive family who kept me sane (more or less) and cheered me on every step of the way.

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Chapter 1: Introduction

Conservation auctions are a promising new tool for environmental management that have drawn attention from both policy-makers and academic researchers in the past several years (Latacz-Lohmann and Schilizzi 2005). They represent a way to address environmental issues that are affected by the actions of many individual landowners and thus are often difficult to manage, such as non-point source pollution and habitat protection.

Conservation auctions are based on the fact that landowners generate negative externalities[1] if they reduce environmental quality through their production practices. They can reduce or eliminate the externalities, improving environmental quality, by adopting "beneficial management practices" (BMPs). BMPs include actions such as restoring wetlands or habitat, or changing farming practices to reduce agricultural runoff into waterways. However, the adoption of BMPs is often costly to landowners, involving both opportunity costs (lost production and time) and direct costs (materials). Meanwhile, landowners receive at most a portion of the environmental benefits. Therefore, without intervention, landowners may fail to adopt socially desirable BMPs.

One means to address this problem, which gained attention in the 1980s, is agri-environmental contracting, also known as payments for environmental (or ecosystem) services, or PES. In these programs, the government, or another party, such as a forestry company or development agency, offers a fixed payment to landowners in return for the adoption of specific BMPs. These are usually cost-share programs that do not cover the full costs of BMP adoption.

However, contracts for BMPs are subject to a severe difficulty: the purchasing party does not usually know the adoption costs of individual landowners. Furthermore, these costs are generally heterogeneous among landowners since they depend on land characteristics as well as existing management practices. Therefore, payments are set at some uniform estimate of

[1] Negative externalities are negative effects on parties who are not directly involved in a transaction, such as people living downstream from a farmer who pollutes a waterway.

costs, instead of being tailored to the actual adoption costs of landowners. This gives rise to a problem of adverse selection: landowners who need to make fewer changes to their management practices are more likely to participate, since their adoption costs are lower; however, the environmental benefits resulting from their participation are smaller (Latacz-Lohmann and Schilizzi 2005). Thus, these programs are unlikely to be cost-effective.

Conservation auctions have the potential to overcome this problem of asymmetric information, by revealing information about landowner costs. In this type of auction, the government (or other purchasing party) asks landowners to submit bids for a limited number of conservation contracts, which involve either specific BMPs or specific environmental outcomes. The best bids, based on environmental and cost-effectiveness criteria, are selected, and these landowners enter into contract with the government. Latacz-Lohmann and Van der Hamsvoort (1997, 1998) show that since optimal bids are a function of the net costs of adoption, the auction mechanism is able to reveal information about these costs.

However, a number of factors affect the ability of the government to use conservation auctions to cost-effectively achieve environmental goals. One is the design of the auction itself. In the discriminatory price auction analyzed by Latacz-Lohmann and Van der Hamsvoort (1997, 1998), the cost revelation mechanism is imperfect. Because the government does not know their actual costs, bidders have an opportunity to behave strategically and capture information rent[2] by over-bidding relative to costs. Bidders' incentives and abilities to take advantage of this opportunity are affected by a number of design choices including the use of a reserve price, the information offered to landowners, and the criteria used for choosing bids. While a uniform pricing mechanism (where all bidders are all paid the same amount) gives bidders an incentive to bid their true costs, it finally requires overpaying all successful bidders and thus may or may not be an improvement over the discriminatory price auction. Therefore, "success of conservation auctions depends on having a thorough understanding of bidding

[2] Information rent, in this case, is income that the landowner receives over and above the actual costs of adoption, which is possible because the landowner has information about those costs that is unknown to the government.

behaviour and paying close attention to design details" (Latacz-Lohmann and Schilizzi 2005: 2).

A second factor which is likely to influence the success of a conservation auction is the social context in which the auction takes place. Social factors such as norms, reciprocity, leadership, altruism, and fairness have been shown empirically to impact people's behaviour in many different aspects of life, including behaviour related to the environment (e.g. Bouma et al. 2008, Krishna 2001, Nyanena 2006). A number of social factors have been shown to influence BMP adoption decisions (Pannell et al. 2006). Therefore, these factors may also impact landowners' participation in conservation auctions, and thereby influence the cost-effectiveness and environmental outcomes of these auctions.

In fact, it is worth noting that social factors may also influence the more fundamental decision of whether or not to use a conservation auction to address a particular environmental issue. The appropriate policy mechanism for a given situation is dependent on the public and private net benefits of the actions to be undertaken (Pannell 2008). If social factors affect these benefits and costs, they may also affect the choice of policy mechanism. While this study does not address this issue directly, it does call attention to the importance of considering these factors in research on such mechanisms.

The issue of social factors has seen little attention in the literature on conservation auctions, thus far. In part, this may be due to the fact that because of the expense involved with running real conservation auctions, research and test-bedding of these auctions is often carried out through simulated auctions in the laboratory. In this context, concerns for participant anonymity and efforts to control for extraneous factors provide little opportunity to observe the impacts of social factors. However, real conservation auctions take place in real social contexts. Landowners are likely to know each other, observe each other's actions, and interact with each other before, during, and after the program. Therefore, it is important to identify the social factors that may affect behaviour within, and outcomes of, conservation auction programs.

This study examines three elements of the social context that may affect the ability of policy-makers to achieve environmental goals using conservation auctions: social capital, leadership, and the issue of "crowding out." Social capital is a multi-faceted concept that involves connectedness and networks between individuals and groups, trust, reciprocity, and social norms. It is likely to be heterogeneous across different contexts where conservation auctions may be implemented, and therefore may be an important factor influencing different behaviours and success rates from one auction to another. Leadership is another factor that is likely to be heterogeneous across different social contexts, since both the type and strength of leadership may differ across communities. Since leaders influence the behaviour of others through a variety of different mechanisms, leadership may also have an impact on auction success. The issue of crowding out suggests that the introduction of an external financial motivation to adopt BMPs may diminish other motivations for adoption, such as social norms or altruism. This implies that conservation auctions may have a negative impact on voluntary BMP adoption, especially if the program only provides temporary payments.

As in many other studies of conservation auctions, the impact of these social factors is studied using controlled lab experiments. However, unlike existing studies in the literature, these experiments are designed to include mechanisms through which the social factors being investigated may play a role. The experimental treatments simulate the effect of different social contexts by varying levels of social capital and leadership, and allowing socially-motivated behaviour to influence individual decisions. Thus, this research improves our understanding of the social factors affecting behaviour in conservation auctions, which offers guidance to improve the design of such auctions.

We find that both social capital and leadership have multi-dimensional, context-specific effects on bidder behaviour and auction outcomes. Group-level social capital appears to lower bids and positively influence outcomes, while the individual-level social capital scores of people who do not know each other has no discernable impact. However, even in existing groups, it appears that social norms have a strong impact on behaviour only when BMP adoption directly affects

participant outcomes, through group bonuses for achieving an environmental target.

Leadership, too, has complex impacts; overall, leaders tend to raise bids and have a negative effect on auction outcomes, but the channels through which this occurs vary depending on the existence of social networks among participants. In particular, when social connections already exist, collusion ("gaming" the auction) appears as a major concern. The specific mechanisms through which BMP adoption affects participants also appears to have an impact, as the provision of bonus group payments may partially offset the incentive to collude.

In the experiments dealing with crowding out, we find that the introduction and subsequent removal of a conservation auction significantly reduces voluntary provision of environmental quality, via monetary donations to an environmental charity, compared to a control group that does not experience an auction. This suggests that crowding out may indeed be a concern for conservation auctions, and implies that auction designers need to pay attention to social context and motivations to minimize harmful effects on voluntary BMP adoption.

Besides the policy implications, the experiments in this study also play a role in linking the literature on social factors to the literature on market-based instruments. While a number of studies have linked social capital and leadership to conservation decisions, few have looked at market-based instruments and none (to the best of our knowledge) have examined this link for the particular case of conservation auctions. Our approach to studying these issues is also unique, as we use existing characteristics of participants to create the experimental treatments, rather than artificially creating social capital or leadership opportunities through the structure of the experiment.

The crowding out experiment also provides an important contribution to the literature. While this issue has been previously studied (Reeson and Tisdell 2010), our experiment provides a closer parallel to real conservation auctions by using real BMP adoption costs, framing the auction in terms of conservation, and,

most importantly, providing incentives that reflect the fact that most benefits of BMP adoption go not to the landowners themselves, but to wider society.

The next chapter of this thesis provides an overview of conservation auctions by reviewing the existing theoretical and empirical literature. The following three chapters introduce the issues of social capital, leadership, and crowding out, describe the experiments used to examine their potential influences on conservation auctions, and report the experimental results. The resulting conclusions are summarized in the final chapter.

Chapter 2: Conservation Auctions

Conservation auctions have been used in the field for several years, although they are still one of the newer tools for environmental protection. An early example of a conservation auction is the Conservation Reserve Program in the United States, which began in 1986. Another well known auction program is BushTender in Australia, which ran from 2001-2003. A number of other auctions have been employed in countries including Germany and Scotland, as well as several more in Australia. In Canada, the non-profit organization Ducks Unlimited has implemented auctions aimed at conservation easements in the prairie provinces (Brown et al. 2010) and at restoring wetlands on agricultural land in Saskatchewan (Hill et al. 2011). Promising results from several of these programs have generated an increasing interest, among both policy-makers and academics, in researching conservation auction theory, design and outcomes.

Theoretical Literature and Model

There is a well-developed economic literature on auction theory. Unfortunately, most of this literature does not apply to conservation auctions since they have a number of unique characteristics. In standard theory, the Revenue Equivalence Theorem (Myerson 1981, Riley and Samuelson 1981) states that any auction design that satisfies certain basic assumptions will result in the same expected revenue for the seller. However, Latacz-Lohmann and Van der Hamsvoort (1997) argue that conservation auctions violate these assumptions in several ways, making the Revenue Equivalence Theorem, and its implications for optimal auction design, inapplicable. First, the assumption of risk neutrality is violated if landowners are risk-averse. Second, bidding is not symmetric; land characteristics and opportunity costs differ across landowners, meaning that improvements in environmental quality may differ even when bid amounts are identical. Third, payments may depend not only on the bids themselves, but also on other factors such as making payments conditional on environmental

outcomes. Fourth, the cost of bid construction may be nonzero. In addition, conservation auctions involve multiple contracts instead of a single contract. Because of these complexities, existing auction theory cannot determine the optimal design for a conservation auction.

Thus, the major theory paper relevant to this study is that of Latacz-Lohmann and Van der Hamsvoort (1997), who present a model of optimal bidding behaviour developed specifically for conservation auctions. The model is based on the idea that farmers have some expectation of a maximum acceptable bid level. To determine the optimal bid, farmers balance the probability that their bid will be accepted (which is decreasing in the bid level) with the net payoff resulting from the bid (which is increasing in the bid level). To provide a framework for investigating the influence of social factors on bidder behaviour, the model is presented here in detail.

The model assumes that BMP adoption will change the profits from farming. Profits from conventional farming are π_0 and profits from conservation farming (with BMPs) are π_1. The assumption is that $\pi_0 > \pi_1$; otherwise profit-maximizing farmers would have adopted BMPs on their own. Profits are an argument in a monotonically increasing, well-behaved utility function U. In the auction, a farmer submits a positive bid amount b. The farmer also has expectations about the maximum bid level that will be accepted, β. He will submit a bid b if:

$$U(\pi_1 + b)Pr(b \leq \beta) + U(\pi_0)[1\text{-}Pr(b \leq \beta)] > U(\pi_0) \quad (1)$$

If the farmer's expectations about β are characterized by a probability density function, f(b) and a cumulative density function F(b), then $Pr(b \leq \beta) = 1 - F(b)$. For a risk-averse decision-maker, since conservation practices and auction participation may affect the variability of farming profits, Latacz-Lohmann and Van der Hamsvoort replace the utility function with a certainty equivalent, expected income minus a risk premium RP. This gives the following condition for submitting a bid b:

$$[\pi_1 + b - RP_1(b)][1 - F(b)] + (\pi_0 - RP_0)F(b) > \pi_0 - RP_0 \quad (2)$$

This can be rearranged to:

$$\{[\pi_1 + b - RP_1(b)] - (\pi_0 - RP_0)\}[1 - F(b)] > 0 \quad (3)$$

When the left-hand side of this equation is maximized with respect to b, keeping in mind that it makes no sense for the farmer to submit a bid below the minimum expected bid cap β_{min} or a bid that does not cover the opportunity costs of changing to conservation farming, the optimal bid level is found to be:

$$b^* = \max \{\pi_0 - \pi_1 - [RP_0 - RP_1(b)] + [1 - \partial RP_1(b)/\partial b][(1 - F(b))/f(b)], \beta_{min}) \quad (4)$$

$$\text{s.t. } \pi_1 + b^* - RP_1(b^*) > \pi_0 - RP_0$$

This shows that the optimal bid is increasing in the net opportunity costs of participation, and in the expected bid cap. The model also predicts that risk-averse farmers will offer lower bids than risk-neutral farmers to increase the probability of their bid being accepted, as long as adopting the conservation practices does not significantly increase the variability of profits. Thus, bids will be affected by factors that change the net opportunity costs of participation, expectations about the maximum acceptable bid, and factors that affect the risk attitudes of landowners.

A second theoretical paper outlines a different type of conservation auction, which combines a team contract with an auction (Taylor et al. 2004). In this auction, which is intended for non-point source pollution where individual actions cannot be monitored, landowners submit individual bids for pollution abatement. These bids are used to select participants into the program. Selected landowners then decide how much abatement to actually provide, and payment is contingent on group performance. If the group as a whole achieves the specified environmental target, each participant is paid their individual bid amount; if the target is not met, no one is paid. Taylor, Randall and Sohngen (2003) show theoretically that in this type of auction, the optimal bid level is a function of abatement costs, but again may be an imperfect cost revelation mechanism.

Empirical Literature

The theoretical models described above leave open many questions about the impacts of different auction design features on bidder behaviour and auction performance. However, several design elements have been tested empirically using simulations, experiments, and pilot auctions. They include pricing mechanisms, reserve prices, target constraints vs. budget constraints, information provided to bidders, number of auction rounds, and group vs. individual payments.

Different pricing mechanisms provide different incentives to bidders and thus affect auction outcomes. The two main options are discriminatory pricing, where each successful bidder receives their bid price, and uniform pricing, where each successful bidder is paid the same amount (often the lowest rejected bid). Discriminatory pricing gives participants an incentive to overbid, since selected participants receive their bid amount, while uniform pricing provides an incentive for truthful bids since lower bids are more likely to be accepted. Hailu and Thoyer (2006) confirm this prediction using an agent-based computer simulation. Cason and Gangadharan (2005) also confirm this prediction for individual behaviour; however, in their experimental study, discriminatory pricing resulted in better auction outcomes because more projects could be purchased under the budget cap.

Auction design can also include a reserve price, which is the maximum price per unit that the government is willing to pay. Reserve prices may be announced to bidders, or unannounced. Little research has been published on the effects of this design feature for conservation auctions, although Latacz-Lohmann and van der Hamsvoort's (1997) theoretical analysis indicates that it may be important, if it changes bidder expectations about the maximum accepted bid. Reichelderfer and Boggess (1988), in their analysis of the Conservation Reserve Program in the United States, argue that using alternative bid selection rules instead of the existing strategy of selecting bids on the basis of a reserve price could have improved the cost-effectiveness of the program. However, a reserve price could also be combined with alternative bid selection rules to increase

competition among bidders and to prevent the government from having to pay an amount above society's value of the environmental good being provided.

A third design issue is the choice between a fixed budget and fixed target. In a budget-constrained auction, bids are accepted until the budget for the auction is exhausted. In a target-constrained auction, bids are accepted until a pre-specified environmental target has been met. Schillizzi and Lactacz-Lohman (2007) find that when auctions are repeated, budget-constrained auctions perform better, in terms of cost-effectiveness and minimizing information rents, than target-constrained auctions. More research remains to be done on this issue.

A fourth factor is the information provided to bidders. Glebe (2007) shows theoretically that concealing information about the environmental benefits of adopting new practices from landowners should reduce auction costs, but also reduces the net environmental benefit of the program. Revealing the environmental benefits, but concealing the bid scoring rule, provides the best outcome. Cason, Gangadharan and Duke (2003) confirm empirically that when landowners are informed about the environmental benefits of their actions, they earn more information rent; in this case, abatement is also lower because high quality sellers use this information to place higher bids, some of which are not accepted. Vukina et al (2008) provide an interesting twist on this issue, using data from a real auction to show that when farmers are given information about specific components of the environmental benefits, certain benefits can actually cause them to reduce their bids, since they apparently value these benefits themselves.

Sixth, auctions may be repeated or single-shot. Repeated bidding rounds may be used to allow bidders to become more familiar with the bidding process and the expected benefits and costs of participating; auctions may also be periodically repeated when contracts expire. Hailu and Schilizzi (2005) use an agent-based computer simulation to show that under repetition, auctions may be less efficient and result in less bidder participation than fixed price programs, since bidders are able to extract information rents by using information gained in previous rounds to increase their mark-ups. Similarly, Schilizzi and Latacz-

Lohmann (2007) show that although auctions perform better than fixed-rate payments in a single-shot program, auctions lose their superiority when rounds are repeated. However, Rolfe, Windle and McCosker (2009), using an experiment with landowners as well as data from a real conservation auction, find that holding repeated bidding rounds can increase the efficiency of auctions, suggesting that repetition allows landowners to gain information in a situation where they may be uncertain about costs and returns, and increases competition.

Finally, auctions may be directed towards individuals, or may involve some element of group cooperation. In one type of group auction (Taylor et al. 2003, Taylor et al. 2004), individual bids are used to select participants into the program, while payment is contingent on group performance. If the group as a whole achieves the specified environmental target, each participant is paid their individual bid amount, while if the target is not met, no one is paid. This mechanism can be used in cases where individual compliance is difficult to measure. Taylor et al (2004) show experimentally that this type of auction can be an efficient way to address non-point source pollution. Another variation of cooperative auction is described by Windle et al (2009). In this auction, landowners submit individual bids for taking action on specific land parcels and are paid individually, but the likelihood of a bid being accepted depends on its location relative to other offered land parcels. Over successive bidding rounds, landowners are able to adjust their bids to coordinate with the bids of other landowners.

A further set of studies on conservation auctions deals with cost efficiency, the primary justification of introducing conservation auctions instead of fixed price programs. Glebe (2008) shows theoretically that a bidding mechanism where farmers choose prices and input levels can be more cost-efficient than a self-selection contract mechanism with different levels of fixed payments. Using data from BushTender, a conservation auction carried out in Australia, Stoneham et al (2003) show that the auction mechanism results in significant cost savings relative to a hypothetical fixed-price program. Connor, Ward and Bryan (2008) find the same results based on another Australian auction

program, Catchment Care, while Windle and Rolfe (2008) compare two real programs, an auction mechanism and a fixed price program, and conclude that the auction mechanism is more cost-effective. However, Schilizzi and Latacz-Lohmann (2007) cast some doubt on these conclusions, showing experimentally that although single-shot auctions are more cost-effective than a fixed price program, the fixed price program actually outperforms the auctions under repetition.

Thus, several different design features of conservation auctions have been studied in the literature, both theoretically, experimentally, and using real case studies and pilot auctions. However, to the best of our knowledge, no existing studies address issues related to the social context within which landowners act. Although some auction designs (Taylor et al. 2004, Windle et al. 2009) do allow landowners to interact to some extent, the potential effects of social factors and the connections between landowners on their behaviour in auctions have not been directly studied. However, other research (reviewed in the following chapters) has shown that these factors affect behaviour in many other aspects of life, including conservation behaviour. This suggests that there is a need to study how these factors might influence landowner behaviour within, and the resulting outcomes of, conservation auctions.

Chapter 3: The Influence of Social Capital on Conservation Auctions

Social capital is a multi-faceted concept related to the social networks and connections between people (Pretty and Ward 2001). While social capital has seldom if at all been considered in the conservation auction literature, a variety of studies demonstrate its impacts on behaviour in other aspects of life, and thus suggest that social capital may be important for conservation auctions as well. The experiments described in this chapter investigate this hypothesis.

Economic Definitions and Theories of Social Capital

As yet, there is little agreement among economists on a precise definition of social capital (Hayami 2009). Pretty and Ward (2001) identify four main aspects that summarize common themes in the literature: relations of trust; reciprocity and exchanges; common rules, norms and sanctions; and connectedness, networks, and groups. However, different economists place different emphases on these various themes, and also differ on the key question of whether these elements of social interaction are embedded within communities, or within individuals.

Some economists, following the sociological interpretation of, for example, Putnam (2000), see social capital as interpersonal networks that are embedded in specific communities, meaning that "the same individuals will exhibit different levels and types of social capital depending on the social interactions in which they are engaged" (Bowles and Gintis 2002: F420-21; see also, Wilson 2000, Durlauf and Fafchamps 2005, Dasgupta 2005, Hayami 2009).

Others, however, see social capital as an individual asset, comprising "a person's social characteristics – including social skills, charisma, and the size of his Rolodex – which enables him to reap market and non-market returns from his interactions with others" (Glaeser et al. 2002: F438). In the individual interpretation, these characteristics are transferrable between the different contexts

in which an individual may find himself. This individual concept of social capital was introduced by Loury (1977) and has given rise to a number of economic studies that measure social capital using individual answers to survey questions, finding significant correlations with other individual-level characteristics as well as behaviour (Alesina and La Ferrara 2002, Glaeser et al. 2002, Anderson et al. 2004, Karlan 2005, Kaasa and Parts 2008).

Given this lack of consensus, this study takes a hybrid approach to conceptualizing and operationalizing social capital. For the sake of theoretical analysis, it adopts the individual interpretation of social capital, which makes possible the use of typical economic models of individual behaviour to analyze bidder behaviour in conservation auctions. These theories are outlined below. However, the experimental design allows for both the individual and collective approaches to play a role in creating experimental treatments related to social capital.

Because of the multi-dimensional nature of social capital, economists have tended to develop theories focusing on individual components of social capital instead of an over-arching theory of social capital as a whole. Some of these theories are useful for analyzing the potential impacts of social capital on conservation auctions.

One element of social capital that has attracted attention in the economic literature is social norms. Social norms are unwritten, generally agreed upon rules regarding what behaviour is socially acceptable and what behaviour is not. They are generally modeled by economists as some function of average behaviour or the frequency of a behaviour in a population.

Most theories of social norms (Akerlof 1980, Hollander 1990, Lindbeck et al. 1999, Nyborg and Rege 2003b, Rege 2004, Levitt and List 2007, Nostbakken 2009) are based on the idea that a person who obeys social norms earns social approval from others, and that disobeying social norms results in social disapproval. Social approval and disapproval are assumed to be components in individual utility. A person who acts in a way that obeys the norm thus receives additional utility from her actions, making her more likely to choose