SOCIAL REWARDS AND THE DESIGN OF VOLUNTARY INCENTIVE MECHANISM FOR BIODIVERSITY PROTECTION ON FARMLAND

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27 May 2015

Abstract

We examine how endogenous social preferences—in particular, reputational concern conditional on social norm (i.e., average opinion regarding biodiversity protection on private land)—could affect standard economic incentive mechanism design to encourage biodiversity protection on private land. Behavioural economists have argued that protecting nature without compensation may increase a farmer's social reward, whereas when he protects biodiversity on her farmland only for the monetary reward, this social reward decreases – the classic *crowding out effect.* People, however, vary in social preferences and some farmers may engage in conservation activities merely to 'buy' a good social reputation rather than for the sake of the public good as such. The policy maker's dilemma is that of asymmetric information; he does not know the specific motivation to engage in the conservation activity of the individual farmer. We investigate an optimal voluntary incentive mechanism design that specifies a menu of monetary-transfer-to-effort that gets the best out of both types of farmers. Our results show that (a) social reward can induce the 'early birds' who used to be green even before other farmers undertake voluntary biodiversity protection on their land; and that (b) a decision maker can protect biodiversity on farmland at a lower cost by allowing farmers who are merely interested in social reputation to purchase a 'socially responsibility reward'.

Key Words: Mechanism Design, Collective Identity, Crowding out, Public goods, Agriculture, European Union

JEL-code: D03 (Behavioural micro-economics - underlying principles)
Q57 (Environmental Economics - biodiversity conservation)
Q58 (Environmental Economics - governmental policy)

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1. Introduction

Financial incentives are currently the most widely used instrument to enhance biodiversity, landscape quality and other agro-ecosystem services in European agricultural areas (OECD 2010). Farmers can voluntarily opt to carry out conservation practices by participating in agri-environmental schemes for which they receive payment. The ecological and economic effectiveness of economic incentives for biodiversity conservation remains contested however (e.g., de Snoo et al. 2012). In addition there is increasing evidence that farmers (also) engage in voluntary biodiversity conservation activities for which they do not receive payment. Psychologists have attributed this to non-financial motives, in particular to self-identity (see Lokhorst et al., 2014). From this perspective it may be considered that all farmers practice conservation, or more generally environmental stewardship to some degree, but some to a much greater extent than others.

Economists frequently do not distinguish individuals' underlying motivations however social and psychological effects can motivate agents to participate in environmental projects seen undesirable from a profit maximising perspective (Banerjee and Shogren, 2010). There is little doubt that where agricultural stewardship of the countryside and its amenities is concerned, farmers obtain non-monetary satisfaction. Their multi-utility objective function includes some social reward for actions that benefit others and they derive utility from their own altruism (Colman, 1994, p. 306).

The extant economic literature on farmer participation in agri-environmental schemes is substantial but in this context their (group) behaviour has gained limited attention. Little attention has been given to variation in pre-existing intrinsic motivation, how economic incentives induce changes in motivational structure and how this may affect conservation efforts. Of particular concern is that offering economic incentives to foster prosocial behavior can have crowding out effects of intrinsic motivation, reducing the total contribution provided by agents (Frey 1997). The (psychological) notion of intrinsic versus extrinsic motivations pertains that these motivations do not necessarily have to be complimentary, contrary to a common assumption implicit in micro-economics (Bowles 2008). Specifically in the context of biodiversity conservation, a growing body of empirical studies supports the hypothesis that economic incentives can impact on intrinsic motivation (Rode et al., 2014). These crowding effects are expected to be person and context specific since it follows from the meaning the payment conveys to the recipient rather than from the use of economic incentive *per se* (Bowles and Polonía-Reyes, 2012). There is also further complexity stemming from the cultural and contextual setting and heterogeneity therein. Farmers are known to constitute a judgemental peer group and to compare themselves continually (Burton and Paragahawewa 2011). Unlike many other occupations, work on the land is open to the direct, uninvited and unavoidable scrutiny of the peer group and thus "agricultural land becomes the display of the farmer's knowledge, values and work ethic" (Rogge et al., 2007, pg 160).

This paper examines the non-separability of self-interest and endogenous social preferences—in particular, reputational concern conditional on social norm (i.e., average opinion regarding biodiversity protection on private land)—and how this could affect standard economic incentive mechanism designed to encourage biodiversity protection on private land. Reputational motivation refers to when a person's behaviour is guided partly by how others perceive her type, nature, value, or action (Weigelt and Camerer, 1988; Akerlof, 1980). A reputation-seeking farmer seeks social approval of behaviour and takes actions in line with *the right thing to do*. What *the right thing* is depends on the prevailing social norm which is endogenously influenced by institutional factors (e.g., society, taste, religion, property rights), distribution of preferences (i.e., the number of people actually having a particular type of preference), time, place, and so on. This norm driven reputational payoff is governed by two factors: *honour* and *stigma*. When only a few heroic people do the right thing, then those 'early birds' enjoy an honour from leading-by-example (Hermalin 1998; Vesterlund 2003; Potters et al., 2007) — the perception that 'no one does it' makes this behaviour valuable (e.g., a scarcity rent) and those who do it becomes 'social heroes'. On the other hand, those who do not participate are not facing any social pressure or stigma. But, the same non-participation might be viewed as 'just not done' in other places or at other moments in time. In that case, abstention from the social project becomes morally unacceptable. Thus people will start complying with the norm to avoid being socially outskirt—stigma driven behaviour.

Consider now how this interaction is important in our case of biodiversity protection on private land. Suppose the prevailing norm suggests biodiversity protection is a noble work. Also, assume that the average farmer thinks that few colleagues do this. Then it is socially acceptable for a farmer with no social preferences to not take part in such action. A *green* farmer with social preferences, however, enjoys a non-monetary reputational value by doing such work before others do—honour from leading-by-example. If the regulator were to pay a monetary compensation for this action, the green farmer would not be able to indulge in the leading-by-example causing a crowding out effect. In contrast, other farmers might not have such strong social preferences for protecting the environment—*brown* type farmers. They will take action to protect the environment only if they receive a sufficiently large monetary compensating to cover their forgone economic profits and additional costs.

Now suppose the community standard shifts *green*-ward—i.e., more farmers start doing the right thing. Two effects will follow. Those heroic early birds will no longer be able to gain their personal satisfaction (honour). They might lose their motivation to continue with the green action—strategic substitution between their own contribution and average contribution in the community. On the other hand, it now becomes socially unacceptable to not taking actions to protect biodiversity on private land. Thus the brown farmers will comply with the norm as there is now stigma attached to abstention.

The policy maker’s dilemma is that of asymmetric information; he does not know the individual farmer’s specific motivation to engage in the conservation activity. He does not want to pay a *green* farmer (with social preferences) to avoid crowding out the private incentive. When more farmers start participating into the program following the norm, those early birds will lose their 'honour'. The regulator does not want to undermine these green farmers’ motivation. The regulator also does not want to pay extra money to a *brown* farmer (social reputation seeker) due to opportunity cost of public fund. This would imply spending public funds on r those who wish to comply with the norms. Under asymmetric information, he knows a farmer can be one of two types – green or brown. But he cannot distinguish between them. The challenge is how to design a monetary incentive mechanism that would get best out of different types of people with varying social norms. We investigate an optimal voluntary incentive mechanism design that specifies a monetary-transfer-to-efforts menu that gets the best out of both types of farmers. Our results show: (i) social reward can induce the ‘early birds’ who used to be green even before other farmers start doing biodiversity protection; and (ii) the policy maker can save some public fund as brown farmers want to buy reputation.

2. Mechanism design with standard preferences

Consider each farmer is endowed with fixed acres of homogeneous land, X. A farmer decides whether to enrol x acres of this land for biodiversity protection, $x \geq 0$ and$x \leq X$, by implementing organic farming, conservation practices or restricting agricultural activity to shelter endangered species, and so on. Such action taken by the farmer is privately costly,

$C(x;\Gamma)$, where C is a standard cost function. The opportunity costs of introducing pro-environmental methods of farming depend on both the number of acres and on land quality, i.e., marginal productivity of the land (see Hanley et al., 2012). The term Γ is the productivity parameter—everything else equal, an extra acre of land dedicated to biodiversity-friendly farming incurs higher opportunity costs for a higher Γ. The farmer receives a monetary transfer, t, from the regulator to compensate the forgone profit for each acre of land enrolled.

In addition the farmer gains a positive ecological externality if other farmers in the community also employ biodiversity-friendly farming practice on their land. This is because of the improvement in the overall situation regarding natural predators for crop protection, diversity of pollinators, preservation of water stock, flood control and soil conservation and so on, and these benefits depend on aggregate behaviour. Let $Ext(x^e)$ denote the positive externality (e.g., ecological externality) enjoyed by the farmer from average acres of land used for biodiversity/ecological protection by other farmers, x^e, where $x^e = \frac{\sum_{j\neq i}^{n} x_j}{n-1}$, with a total of *n* farmers in the community. The positive ecological externality can be financially rewarding. Environmentally responsible farming practice can be cost saving and the maintenance of an attractive landscape, ecological diversity or uptake of organic farming can increase profit as consumers have preferences for such 'green' products. This monetary pay-off depends on both the individual farmer's action and also on other farmers' actions. Let $\pi(x^e, x)$ be the material profit from practicing green farming. The utility of a farmer is

$$U = Ext(x^e)[\pi(x^e, x) + tx] - C(x;\Gamma) \qquad (1).$$

According to standard voluntary mechanism design, a regulator aims to maximise social welfare from biodiversity protection on farmland in such a way that the farmer is no worse off by participating into the program (i.e., satisfying the participation constraint). The social welfare is the social benefit from biodiversity protection and the utility of the farmer minus the opportunity costs of public funds paid to the farmer for participation. Under complete information about the quality of the land, the regulator offers an optimal transfer-to-acre contract, (t, x), to the farmer by which follows from solving the following

$$\max_{x,t} W = B(x^e, x) + U - \lambda tx \text{ s.t. } U \geq 0, \tag{2}$$

where $B(x^e, x)$ is the social welfare function which is concave in its arguments and λ represents opportunity costs of public fund. Expression (2) represents an individual farmer's participation constraint. It implies a farmer should receive a non-negative return from participation. Optimality requires

$$\frac{\partial C(x;\Gamma)}{\partial x} = \left[\frac{\frac{\partial B(x^e,x)}{\partial x}}{\lambda} + \frac{\partial \pi(x^e,x)}{\partial x} + t\right] Ext(x^e) \tag{3}$$

and

$$tx = \frac{C(x;\Gamma)}{Ext(x^e)} - \pi(x^e, x) \quad (4).$$

The FOC of the optimization problem (expression (3)) shows that the marginal costs from participation should be equal to the marginal social benefit weighted by the dead-weight loss of taxation and marginal material payoff to the farmer. Note that the marginal benefit is multiplied by the positive externality from average action and that it depends on both the profit from the farmer's action and also other farmers' actions. This follows standard results in optimal contract design that marginal costs from contribution to public good equalise marginal social benefit and private benefit (i.e., transfer from the regulator to compensate forgone economic profit) (e.g., Laffont 1995; Smith and Shogren 2002; Baliga and Maskin 2003). Once we add the effect of others' contribution to a farmer's own benefit, we find that a typical farmer is willing to contribute more owing to the effect of average farmers' behaviour or social norm. Solving the FOC, an optimal monetary transfer to the farmer can be obtained (expression (4)) which exactly compensates the farmer's contribution in terms of the costs of taking action weighted by the positive externality from average action minus the material profit from the *green*-action. Compared to the traditional contract design, we find a farmer will participate for less money because the forgone economic profit at the individual farm is partially compensated by the gain in profit from group actions toward biodiversity protection.

Under asymmetric information about land quality, a farmer can be one of two types—low and high quality farmer with low and high land quality Γ, $\Gamma \in \{\Gamma^L, \Gamma^H\}$ with $\Gamma^L < \Gamma^H$. A high-quality farmer should earn higher rents than a low-quality farmer. The regulator knows there are two types but cannot distinguish between them. The regulator designs a voluntary incentive mechanism incorporating private information about land quality and offers an optimal contract $\{x^i, t^i\}$ for land retirement so that a farmer of type *i* is no worse off when he voluntarily chooses the contract, $i = L, H$. According to the Revelation Principle, if the farmer accepts the contract, he retires the land and receives compensation as specified in the contract. The mechanism provides the incentive for each farmer to reveal this private information. The regulator's goal is to choose the contract by maximising the social welfare which is the weighted average of the utility of the farmers, including the benefits from biodiversity protection, net of the cost of funding the project,

$$\max_{x,t} W = q[B(x^e, x^L) + U^L - \lambda t^L x^L] + (1-q)[B(x^e, x^H) + U^H - \lambda t^H x^H] \quad (5)$$

where, q is the probability of that the farmer is Low-type. The regulator has to consider the following (binding) participation and incentive compatibility constraints,

$$Ext(x^e)[\pi(x^e, x^H) + t^H x^H] - C(x^H; \Gamma^H) \geq 0 \quad (6)$$

$$Ext(x^e)[\pi(x^e, x^L) + t^L x^L] - C(x^L; \Gamma^L) \geq Ext(x^e)[\pi(x^e, x^H) + t^H x^H] - C(x^H; \Gamma^L) \quad (7)$$

A high quality farmer does not have any incentive to hide her private information of land quality, he will participate if expression (6) is satisfied (participation constraint). Under asymmetric information, a low quality farmer, however, mimics the high quality farmer. If the low quality farmer's net gain from participation is the same (at least) as the net gain of the high quality farmer, the dominant strategy is to reveal the private information and take part in the program (i.e., the incentive compatibility constraint (7) is satisfied).

Substituting (6) and (7) into (5), the FOC of the optimization problem implies

$$(1-q)\left[\frac{\frac{\partial B(x^e,x^H)}{\partial x^H}}{\lambda}+\frac{\partial \pi(x^e,x^H)}{\partial x^H}\right]Ext(x^e)\ -\lambda\frac{(1-q)}{q}\left[\frac{\partial C(x^H;\Gamma^H)}{\partial x^H}-\frac{\partial C(x^L;\Gamma^L)}{\partial x^L}\right]=0 \quad (8)$$

$$q\left(\left[\frac{\frac{\partial B(x^e,x^L)}{\partial x^L}}{\lambda}+\frac{\partial \pi(x^e,x^L)}{\partial x^L}\right]Ext(x^e)-\frac{\partial C(x^L;\Gamma^L)}{\partial x^L}\right)=0 \quad (9).$$

The high quality farmer sets aside fewer than optimal acres of land for biodiversity protection (as shown in expression (8)) and the low-type farmer sets aside optimal acres of land (expression (9)) at the margin. Solving the FOCs, we have,

$$t^H x^H=\frac{C(x^H;\Gamma^H)}{Ext(x^e)}-\pi(x^e,x^H) \quad (10)$$

$$t^L x^L=\frac{C(x^H;\Gamma^H)}{Ext(x^e)}-\pi(x^e,x^H)+\left[\frac{C(x^H;\Gamma^H)-C(x^L;\Gamma^L)}{Ext(x^e)}\right] \quad (11).$$

In addition, the low-type farmer captures positive information rents, as shown in (11), because he mimics the high-quality farmer (as $\left[\frac{C(x^H;\Gamma^H)-C(x^L;\Gamma^L)}{Ext(x^e)}\right]>0$ since $C(x^H;\Gamma^H)>C(x^L;\Gamma^L)$). The high quality farmer obtains zero information rents as he does not mimic the low-quality farmer because then he would incur a monetary loss. The regulator surrenders this information rent because he wants to keep the high-quality farmer in the project. Also, the regulator accepts the high-quality farmer's participation in term of acres although it is less than the optimal level in order to minimize the information rents paid out. This is a standard result in mechanism design with rational and self-interested agents under asymmetric information (e.g., see, Smith and Shogren 2002; Baliga and Maskin 2003). However, optimal participation in terms of land in the program and the volume of monetary compensation for both types of farmers is reduced compared to the traditional case due to the positive impact of exogenous social norms.

3. Mechanism with social preferences and endogenous norms

Now we consider the role of social preferences in contract design. We allow some heterogeneity in individual farmers' degrees of altruism and moral reputation. We assume that all farmers have three motives when extending effort to biodiversity protection: extrinsic, intrinsic, and reputational. This section investigates the interaction between these motives and how incentives affect them given an exogenous social norm. As we discussed in the previous section, a farmer enjoys an extrinsic material payoff by undertaking biodiversity-protection actions on land, i.e., $\pi(x^e, x) + tx$. Let ϑ_t denote the farmer's intrinsic valuation of money; she then enjoys intrinsic satisfaction, $\vartheta_t tx$, when he receives *t* monetary transfer from the regulator, and sets aside *x* acres of land for biodiversity protection. In addition he enjoys an intrinsic satisfaction, ϑ_x, when undertaking actions to protect biodiversity on *x* acres of private land (i.e., a true altruism). We assume that $\mathbf{V} \equiv (\vartheta_x, \vartheta_t)$ follows a distribution function *F(**v**)* and density *f(**v**)* with mean $\left(\overline{\vartheta_x}, \overline{\vartheta_t}\right)$. Its realization is private information.

A farmer's choice to undertaking actions for biodiversity protection depends also on the *reputational* value. Reputation captures society's judgments and reactions to a private farmer's contribution toward biodiversity protection. Assume the value of reputation *R* depends linearly on observers' posterior expectations of the farmer's psychological attributes, e.g., whether he intrinsically cares about biodiversity or does so only for money. Following

Bénabou and Tirole (2006), reputational payoff from choosing x given the monetary incentive t is,

$$R(x,t) = \alpha[\gamma_x E(\vartheta_x|x,t) - \gamma_t E(\vartheta_t|x,t)] \quad ; \qquad \gamma_x, \gamma_t \geq 0,$$

where α captures the *visibility* of a farmer's contribution to biodiversity protection, and γ_x and γ_t express how a farmer would like to be perceived—*socially responsible* (γ_x) or *selfish* (γ_t). Assume γ_x and γ_t are exogenously given. Visibility and the weight a farmer assigns to reputation define the farmer's overall concern about reputation, $\alpha\gamma_i, i = x, t$. For simplicity, assume reputational concern is identical across farmers, with fixed γ_i and α.[1]

To focus on how social preferences could play in contract design, we assume that the effect of aggregate action toward biodiversity protection on positive externality and material profit are normalised to one (i.e, $x^e = 1$ and $Ext(x^e) = 1$). Then the utility function of the farmer becomes

$$U = \pi(x) + \vartheta_t tx - C(x;\Gamma) + \vartheta x + R \, .$$

Solving for private utility, the maximisation problem of a farmer gives us the following first order conditions,

$$\frac{\partial C(x;\Gamma)}{\partial x} = \frac{\partial \pi(x)}{\partial x} + \vartheta_t t + \vartheta_x + R_x \qquad (12)$$

and, second order condition requires $\pi_{xx} - C_{xx} + R_{xx} < 0$. Intuitively this FOC means that the farmer's marginal costs from actions towards biodiversity protection should be equal to the marginal benefit obtained from private payoff (e.g., selling organic products at a

[1] The marginal impact of land retirement on reputation is positive, $R_x = \alpha\left[\gamma_x \frac{\partial E(\vartheta_x|x,t)}{\partial x} - \gamma_t \frac{\partial E(\vartheta_t|x,t)}{\partial t}\right] = \alpha[\cdot] > 0$. A landowner who retires land for species protection sends a positive signal about his social preferences, i.e., $\frac{\partial E(\vartheta_x|x,t)}{\partial x} > 0$. Also, other people think the landowner's decision might not be driven by money, i.e., $\frac{\partial E(\vartheta_t|x,t)}{\partial x} < 0$ (see the proof of Proposition 2 in Bénabou and Tirole, 2006).

premium, revenue from tourists attracted by the landscape etc.) and satisfaction from monetary compensation from the regulator, intrinsic value, and reputational gain.

The regulator encourages social behaviour through public displays and advertising (for simplicity, we assume that advertising a farmer's contribution is costless), as

$$\frac{\partial x}{\partial \alpha} = \frac{R_{x\alpha}}{-(\pi_{xx} - C_{xx} + R_{xx})} > 0 \qquad (13)$$

Since greater publicity for a farmer's contribution leads to a greater marginal reputational value from the land retirement ($R_x > 0$ and $R_x = \alpha[\cdot]$, then $R_{x\alpha} > 0$), a farmer contributes more to the social project ($\frac{\partial x}{\partial \alpha} > 0$). For simplicity, assume α is exogenously set by the regulator.[2]

Monetary gain could also reduce contributions towards the social project through the classic *crowding out effect* according to which extrinsic incentives reduce the incentives of intrinsically-motivated people (see Bowles 2008). The intuition behind the crowding out effect due to reputation is that a person cares more about reputation than money, and that taking money for doing a socially-beneficial work reduces one's reputation in society. The following comparative static result shows that effect:

$$\frac{\partial x}{\partial t} = \frac{R_{xt} + \vartheta_t}{-(\pi_{xx} - C_{xx} + R_{xx})} \qquad (14).$$

Since receiving tax-payers' money from the regulator for a socially-beneficial project can be viewed as 'money hungry' behaviour, the cross partial derivative of reward for additional reputation (R_{xt}) is negative.[3] A farmer with reputational concerns will reduce the

[2] In the model, α is treated as both visibility and the regulator's choice of some factor that increases visibility. This might better be treated as $\alpha = \alpha(y, \theta)$ where α = visibility, y is the effort by the regulator to enhance visibility, and θ represents exogenous factors. Then we can assume $\frac{\partial \alpha}{\partial y} = 1$, so $\frac{\partial a}{\partial y} = \frac{\partial a}{\partial x}$.

[3] For a detailed mathematical proof, see Proposition 2 in Bénabou and Tirole (2006) and Banerjee and Shogren (2012).

participation *x* given the monetary incentive t , i.e., a crowding out effect ($\frac{\partial x}{\partial t} < 0$), if he values reputational gain more than monetary gain (i.e., $|R_{xt}| > |\vartheta_t|$).

The regulator can design an incentive mechanism to address this crowding out effect by deriving an optimal contract $\{x^i, t^i\}$ to induce a farmer to participate in the biodiversity protection program (see, Banerjee and Shogren (2010, 2012)). By optimizing the farmer's utility, the optimal contract ensures the farmer is no worse off when voluntarily choosing the contract. In this case, intrinsic valuation of species protection is assumed to be identical for all farmers (assume ϑ_x is normalized to 1) and intrinsic valuation of money (ϑ_t) is varied across farmers.

In the benchmark *full information* case, the regulator knows the intrinsic valuation of money for the farmer. The regulator maximizes the net social benefits from protecting biodiversity, by choosing *x* and *t*, subject to the farmer's participation constraint. Optimal regulation implies: (i) information rents are zero; and (ii) the marginal cost of land retirement equates to the marginal benefits from the monetary reward, intrinsic satisfaction, and reputation. Under *incomplete information* about the intrinsic valuation of money, the regulator only knows there are two types of farmers exist – green and brown with low and high intrinsic valuation for money. The regulator knows the *brown* farmer wants to buy reputation; and she knows the *green* farmer might reduce the amount of land she is willing to set aside when offered monetary compensation.

As the regulator cannot distinguish between a green and brown farmer, she designs a mechanism by processing private information provided by the farmers. Each farmer tries to maximize her utility from participating in the mechanism—he may reveal the truth or give false information. A green farmer has nothing to hide if he wants a good reputation. But the brown farmer wants to gain a good reputation by falsely reporting that he has a low intrinsic valuation of money. He *gives up* economic rents to gain a good reputation. And, he retires optimal acres of land for biodiversity protection. The green farmer does not capture any rents and *over-invests* in biodiversity protection (for details, see Banerjee and Shogren 2012). The mechanism is incentive-compatible as reporting the true information is the dominant strategy of each type of farmer.

Previous studies on incentive mechanism design exploiting a farmer's social preferences (i.e., intrinsic motivation, reputational concern, e.g., Hwang and Bowles (2008); Banerjee and Shogren (2010, 2012)) has treated bounded self-interest, or social preferences, as exogenous. In reality, however, preferences are not necessarily always exogenous, and they can depend on institutional factors such as social norm (see Bowles, 1998). Social norms are a set of formal or informal rules that govern an individual's social interaction in a group or society. In a broader sense, norms set rules for behaviour ranging from property rights to the feeling of obligation to a group (e.g., family, community). This prevailing norm actually represents how most people in a given community value a particular social attribute a person should possess.

Reputation depends on how others value a farmer's actions. People's perception about what is good and bad is also time and location specific (see Akerlof 1980). For example, in some places private landowners enjoy killing endangered species whereas in other areas landowners are ready to sacrifice economic rent to protect the nature (Chavez et al. 2005; Mantymaa et al. 2009). In addition, people tend to coordinate with the existing social norm[4]. This complementarity in preferences arises endogenously from the interplay of honour and stigma with the prevailing norm (see Bénabour and Tirole, 2006 and 2011). An action becomes socially unacceptable ('it is just not done') when those who do it becomes socially

[4] For example, walkers-by were more likely to put money into a Salvation Army kettle, when they had observed someone else doing so (Bryan and Test 1967); the number of people who want to receive welfare benefits to live off may increase when more people do the same (since living on benefits may become relatively less embarrassing when more people do the same, see Lindbeck et al 1999).

outliers. In other places and times, the same action can be free of social stigma when 'everybody does it'. Given a norm, the number of people who follow it at a given time and place actually determines whether taking such action will lead to honour or stigma. When only a few 'saintly' people do *the* right thing, they enjoy an honour—a non-monetary scarcity rents or satisfaction. Others, however, do not get any stigma by not doing it as the average opinion is 'no one does it'. When more people start doing the right thing due to some exogenous change in the average opinion, the same people who abstained from biodiversity protection before may now find it beneficial to comply with the average opinion to avoid being socially outskirt. In this section, we re-design our incentive mechanism by incorporating such interaction.

We consider a continuum of farmers and each of them decides whether to participate to the program by using land for biodiversity protection, i.e., each makes a discrete choice $x \in \{0, 1\}$. We also assume that the farmers' intrinsic valuation for money is normalised to one. Farmers differ in their intrinsic satisfaction from land retirement– high ϑ_x leads to high reputational value (i.e., *green* farmer). For notational simplicity, we denote ϑ_x as ϑ. We assume the distribution function of the intrinsic satisfaction from land under conservation practices is $F(\vartheta)$ with finite support $V \equiv [\vartheta_{min}, \vartheta_{max}]$, and the density of ϑ is $f(\vartheta)$, where $f(.)$ is continuously differentiable, with mean $\overline{\vartheta}$. We also define the following two conditional moments, X^+ and X^-, means in the upper and lower tails, for any candidate cut-off ϑ,

$$X^+ = E(\tilde{\vartheta}|\tilde{\vartheta} > \vartheta) \qquad (15)$$

$$X^- = E(\tilde{\vartheta}|\tilde{\vartheta} < \vartheta)\ . \qquad (16)$$

The expression (15) governs 'honour' conferred by participation. Since the intrinsic valuation is above the average level expression (15) corresponds to virtue. The second expression (16) governs ‘stigma’ conferred by abstention. It implies that if a farmer’s intrinsic valuation is lower than the cut-off level, abstention from the project is viewed as irresponsible. The difference between the conditional moments defines net reputational gain, Ω:

$$\Omega = \mu\big(X^{+}(\vartheta) - X^{-}(\vartheta)\big),\ \forall\vartheta \in \mathrm{V} \text{ and } \mu \text{ is fixed.} \qquad (17)$$

Given the green norm and monetary transfer *t*, a farmer dedicates a positive amount of land to biodiversity conservation practices (i.e, $x \geq 0$) if $\frac{\partial U}{\partial x} \geq 0$. We define a threshold level of intrinsic valuation that satisfies this participation, denoted by ϑ^{*}, such that

$$\left.\frac{\partial U}{\partial x}\right|_{x=0} = \pi'(x) + t - C'(x;\Gamma) + \vartheta^{*} + \Omega' = 0 \qquad (18)$$

Assuming an interior solution, the net reputational incentive at the cut-off level is

$$\Omega(\vartheta^{*}) = \mu_t\big(X^{+}(\vartheta^{*}) - X^{-}(\vartheta^{*})\big)$$

When more people start doing ‘the right thing’, ϑ^{*} decreases (see Figure 1), honour from scarcity value decreases, but stigma from abstention worsens. The effect on net reputational incentive depends on the relative strength of honour and stigma. If honour decreases, $\Omega'(\vartheta^{*}) > 0$, the decisions become substitutes—i.e., a farmer who was among the few heroic early birds, withdraws participation when others join the program. An honour effect dominates when the number of farmers who participate in the biodiversity protection program (i.e., ‘do the right thing’) is very low. A complementarity effect is observed when the stigma effect dominates (i.e., $\Omega'(\vartheta^{*}) < 0$)—when only a few deviants fail to comply with the norm[5].

We can explore the effect of the extrinsic incentive on the contribution level. A comparative static result of the following utility maximization problem of an individual farmer shows,

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[5] This holds under certain conditions on the distribution of farmers’ preferences. For details, see Bénabou and Tirole 2006.

$\text{Max}_x\, U = \pi(x) + tx - C(x;\Gamma) + \vartheta x + \Omega$

$$\frac{\partial x}{\partial t} = -\frac{1 + \Omega_{xt}}{\pi'' - C'' + \Omega''} \qquad (19)$$

where Ω_{xt} is the cross partial derivative of net reputational payoff. The expression (19) shows the effect of material incentive on the farmer's choice of acres of land that she wants to enrol in the agri-environmental project. The marginal effect of receiving money for doing the *right thing* reduces the reputational value when more farmers join the program (i.e., $\Omega_{xt} < 0$).[6] Monetary incentive crowds out intrinsic motive as a farmer's social esteem get adversely affected—i.e., material incentives are effective neither for honour-driven behaviour nor for stigma-driven behaviour. This holds under the following conditions: (i) net cost of participation is low; (ii) participations are easily observable (i.e., high μ); and (iii) $1 < |\Omega_{xt}|$.

Consider now an aggregate exogenous shift in the distribution of farmers' preferences such that average opinion becomes *green,* i.e., more and more farmers now think biodiversity protection is the right thing to do and abstain from such action is 'just not done'. The original distribution of intrinsic valuation shifts by $\theta,\ F(\vartheta - \theta)$ with density $f(\vartheta - \theta)$ and with support: $\text{v}_\theta = [\vartheta_{min} + \theta, \vartheta_{max} + \theta]$. Net reputational return becomes: $\mathit{\Omega}_\theta(\vartheta) \equiv \mathit{\Omega}(\vartheta - \theta)$. We normalize ϑ such that min $\mathit{\Omega}$ at $\vartheta = 0$ and min $\mathit{\Omega}_\theta$ at $\vartheta = \theta$. Now, we can define type as: $\beta \equiv \vartheta - \theta$. A *green* type farmer (i.e., high reputational value) with high intrinsic valuation (i.e., $\beta \equiv \overline{\beta}$, where $\overline{\beta} \equiv \overline{\vartheta} - \theta$) . Similarly, a *brown* farmer's intrinsic valuation is low under green 'community standard' i.e., $\beta \equiv \underline{\beta}$, where $\underline{\beta} \equiv \underline{\vartheta} - \theta$.

With the change in average farmer opinion or community standard, which has shifted to 'green', a farmer can be one of two types – green and brown. Under complete information (i.e., when the regulator knows who is green and who is brown farmer), the regulator

[6] Monetary incentive crowds out the reputational motive for honour-driven farmers when the cut-off value of intrinsic motivation is moderately low.

maximizes the following objective function such that the farmer's participation constraint is satisfied,

$$max\ W = B(x^i) + \pi(x^i) + t^i x^i + \vartheta^i x^i + \Omega_\theta^i - C(x^i;\ \Gamma) - \lambda t^i x^i$$

subject to $\pi(x^i) + t^i x^i + \vartheta^i x^i + \Omega_\theta^i - C(x^i;\ \Gamma) \geq \underline{U}$

where, $i = G, B$ and $\underline{U}$ is reservation utility.

Optimality requires,

$$\frac{\partial B(x^i)}{\partial x^i} + \frac{\partial \pi(x^i)}{\partial x^i} + \vartheta^i + \frac{\partial \Omega_\theta^i}{\partial x^i} = \frac{\partial C(x^i; \Gamma)}{\partial x^i} \quad (20)$$

This implies that the marginal social benefit, material profit, intrinsic satisfaction, and reputational gain from agro-environmental project should be equal to the marginal costs. Solving this we obtain optimal acres of land, x*, dedicated to biodiversity protection; substituting x^* into the participation constraint gives the optimal monetary transfer, t^*,

$$t^{*i} x^{*i} = \underline{U} - \pi(x^{*i}) - \vartheta^i x^{*i} - \Omega_\theta^i + C(x^{*i};\ \Gamma)\ . \quad (21)$$

This shows that a farmer *i* is exactly compensated for her forgone economic costs net of the farmer-specific intrinsic and reputational benefit. A green farmer with higher ϑ will receive less transfer than a brown farmer. No information rent is paid out.

Under incomplete information, the regulator knows that the average behaviour/opinion has shifted to 'green' and a farmer can be one of two types – green and brown – but cannot distinguish between them. Assume that the probability that a farmer is green type is *p*. A *green farmer* does not want to hide her private information *when the average opinion is green*. This farmer looks for a contract which provides the same utility that she could get under a brown-community standard – i.e., her participation constraint or individual rationality constraint is satisfied. Under a brown-community standard, this green farmer used to enjoy a *scarcity value* (i.e., the satisfaction of being a 'leader' or 'saint-type' in the community). When more farmers join the 'green club' due to the change in the community standard, she loses the scarcity value. The participation constraint ensures that, even after a change in average behaviour or opinion, this type of farmer is still no worse off by choosing the contract; she should remain indifferent between accepting and rejecting the contract even after the change in community standard. A *brown farmer* wants to mimic a green farmer by hiding her private information about her true intrinsic valuation *when the average opinion is green*. She wants to be viewed as green and hence as the average opinion in the community shifts to green, a brown type joins the program to avoid social stigma and her incentive is to gain reputation as good as the green type. She accepts a contract which gives the same utility as that for the green farmer. Summarizing the above, we have the following formal binding participation and incentive compatibility constraints:

$$U^{GG} \geq U^{GB} \Rightarrow \pi(\, x^G) + t^G x^G + \vartheta^G x^G + \Omega_\theta^{GG} - C(x^G; \Gamma) \geq \pi(\, x^G) + \vartheta^G x^G + \Omega_\theta^{GB} - C(x^G; \Gamma) \qquad (22)$$

$$U^{BG} \geq U^{GG} \Rightarrow \pi(\, x^B) + t^B x^B + \vartheta^B x^B + \Omega_\theta^{BG} - C(x^B; \Gamma) \geq \pi(\, x^G) + t^G x^G + \vartheta^B x^G + \Phi_\theta^{GG} - C(x^G; \Gamma) \qquad (23)$$

where, x^i is the contribution of a type *i* farmer when the average opinion is *green*; t^i is the transfer received by a type *i* farmer when the average opinion is *green*; and Ω_θ^{ii} is the net reputational gain of a type *i* farmer when the average opinion is *i*, with *i* = Green, Brown.

Expression (22) is the participation constraint for the green farmer when community standard is green. Expression (23) represents a brown farmer's incentive compatibility constraint when the community standard shifted to green. The term Ω_θ^{GB} in (22) captures the green farmer's net reputational gain when the community standard becomes brown. The term Φ_θ^{GG} in (23) represents a brown farmer's net reputational gain when she pretends to be a green farmer under green community standard.

The regulator faces a trade-off in designing an efficient mechanism: a green farmer participation could be reduced due to the crowding out effect of extrinsic motivation. Moreover, this type of farmer may lack incentive to take up the project when community standard shifts to green – more farmers join the green club. In contrast, a brown farmer could refuse to participate if the monetary reward were lower when on average farmers are brown. The same brown farmer may refuse the project given monetary transfer when community standard becomes green. Here, we define an efficient mechanism to induce the two types of farmers when the average opinion about biodiversity protection becomes favourable (i.e., green).

$$Max\ W = p\left[B(x^G) + \pi(x^G) + t^G x^G + \vartheta^G x^G + \Omega_\theta^{GG} - C(x^G;\ \Gamma) - \lambda t^G x^G\right] + (1 - p)\left(B(x^B) + \pi(x^B) + t^B x^B + \vartheta^B x^B + \Omega_\theta^{BG} - C(x^B;\ \Gamma) - \lambda t^B x^B\right)$$

Substituting binding constraints into the objective function, we get

$$Max\ W = p\left[B(x^G) + \pi(x^G) + \vartheta^G x^G + \Omega_\theta^{GG} - C(x^G;\ \Gamma) + (1-\lambda)(\Omega_\theta^{GB} - \Omega_\theta^{GG})\right] + (1 - p)\left[B(x^B) + \pi(x^B) + \vartheta^B x^B + \Omega_\theta^{BG} - C(x^B;\ \Gamma) + (1-\lambda)\left\{\left(\pi(x^G) + \vartheta^G x^G + \Omega_\theta^{GG} - C(x^G;\ \Gamma)\right) - \left(\pi(x^B) + \vartheta^B x^B + \Omega_\theta^{BG} - C(x^B;\ \Gamma)\right) + \frac{\vartheta^B}{\vartheta^G}\left(\Omega_\theta^{GB} - \Omega_\theta^{GG}\right) + \left(\Phi_\theta^{GG} - \Omega_\theta^{GG}\right)\right\}\right]$$

The necessary first order conditions imply,

$$x^G: \left(\frac{p}{A}\right)\frac{\partial B(x^G)}{\partial x^G} + \frac{\partial \pi(x^G)}{\partial x^G} + \vartheta^G + \frac{\partial \Omega_\theta^{GG}}{\partial x^G}\left(\frac{p-B}{A}\right) + \left(\frac{B}{A}\right)\frac{\partial \Omega_\theta^{GB}}{\partial x^G} = \frac{\partial C(x^G;\Gamma)}{\partial x^G} \qquad (24)$$

$$x^B: C\,\frac{\partial B(x^B)}{\partial x^B} + \frac{\partial \pi(x^B)}{\partial x^B} + \vartheta^B + \frac{\partial \Omega_\theta^{BG}}{\partial x^B} = \frac{\partial C(x^B;\Gamma)}{\partial x^B} \qquad (25)$$

where, $A = p + (1-p)(1-\lambda)$; $B = \left((1-\lambda)p + (1-p)(1-\lambda)\frac{\vartheta^B}{\vartheta^G}\right)$; $C = \left(\frac{1-p}{\lambda-p}\right)$; and A, B, and C are positive parameters. Compared to the full information case, a green farmer contributes more to the biodiversity protection project because she wants to compensate for the relative reputational loss due to a change in average opinion ($\frac{\partial \Omega_{\theta}^{GB}}{\partial x^{G}} > 0$ in expression (19)). The brown farmer contributes at the optimal level.

From the binding constraints, we can rewrite them,

$$U^{GG} = U^{GB} \Rightarrow \vartheta^{G} x^{G} t^{G} = \Omega_{\theta}^{GB} - \Omega_{\theta}^{GG} \quad (26)$$

$$U^{BG} = U^{GG} \Rightarrow \vartheta^{B} x^{B} t^{B} = \Phi_{\theta}^{GG} - \Omega_{\theta}^{GG} + \vartheta^{G}(\vartheta^{G} x^{G} t^{G}) + U^{GG} - U^{BG} \quad (27)$$

The binding participation constraint (26) reveals the fact that the green farmer needs some extra rent to compensate the relative reputation loss due to a change in average behaviour (i.e., scarcity rents). This extra rent cannot be a monetary compensation as that would crowd out the private incentive of the green farmer. We argue this needs to be a 'social reward' that recognizes and celebrates this individual's 'early bird' role in biodiversity protection when the average behaviour was still brown. This finding is in line with Besley and Ghatak (2008) who argue that motivated agents need a 'status incentive' to participate in a pro-social programme. In contrast, a brown farmer pretends to be a green farmer when the community standard becomes green. She would like to gain a reputation as good as the green farmer and would be happy to give up economic rent to gain such a green reputation (since $\Phi_{\theta}^{GG} < \Omega_{\theta}^{GG}$ in (27)).

4. Application: unpaid agri-environmental measures in England

The main application of the model developed in section 3 is to the role of social norms in the voluntary provision of public goods in the rural setting and how this interacts with green payment schemes. From the point of view of our framework of the trade-off between social social preferences, endogenous norms and monetary reward, of particular interest is the growth of farmer-organisation-led initiatives to promote the voluntary uptake of unpaid environmental land management during a period characterised by a movement towards green payment policies, in the European Union in particular[7].

A main example is in the UK where the farming organisations launched the Campaign for the Farmed Environment (CFA) to improve the environmental conditions of agricultural habitats and landscapes throughout lowland England. The Campaign is to be reflected upon against the background of the Environmental Stewardship (ES) scheme which is the main representation of a government-led green payment scheme in England since 2005.

The ES established a right for all farmers to receive payment for the provision of countryside goods[8], whatever their counterfactual position (Hodge and Reader, 2010). It represented a clear shift away from previous programs targeted spatially on particular types of area. Thus the ES allows all farmers to participate. The implication is that the provision of countryside goods can be enhanced both by reducing the intensity of production in more intensively farmed areas, such as by the introduction of buffer strips and the management of linear features such as hedgerows, as well as by supporting farming in less intensively managed areas where the existing farming practices delivers environmental benefits.

The literature on the ES has many references to problems that are consistent with our focus on different types of motivations. A main issue is that there is no incentive for farmers to do more than the minimum necessary since the payment is for the implementation of the specific conservation practices, not for the ecological result. Worse, the prescription of

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[7] Agri-environmental schemes became a mandatory part of the policy toolkit in EU Member States as part of Pillar II (Rural Development Policy) in 2005. These schemes now constitute a central element of the Common Agricultural Policy in terms of agricultural area covered and expenditures. Over 2007-2013, the annual average spending from EU's Fund for Rural Development was €3.3 billion. Farmers self-select from a menu of conservation options and enrol in 5 year contracts.

[8] The scheme's primary objectives are to: conserve wildlife (biodiversity); maintain and enhance landscape quality and character; protect the historic environment; protect natural resources (water and soil), and promote public access and understanding of the countryside.

management practices and designation of specific areas for agri-environmental work fails to allow farmers to develop or demonstrate skilled performance (Burton et al. 2008). Thus, farmers might well be interested in conservation as such and have their own ideas but might not engage because current schemes are top-down[9]. In addition there is a lot of anecdotal evidence that the scheme is associated with high private transaction costs that are not covered by the payments (because these are calculated based on profit foregone).

CFE began in 2009 as an industry-led approach initially for maintaining the environmental benefits provided by former set-aside[10]. More specifically the CFA promotes the on-farm environmental action through one or more of three options: choosing key in-field target options in the ES; retaining former set-aside and any other areas of uncropped land (unpaid), and putting areas of land outside the ES into Campaign voluntary measures (unpaid). Communications include a website, Campaign leaflets and brochures, and CFE led events, as well as a visible presence at a wide range of national, regional and local events operated by partner organisations. The delivery of programme as such is at the local (county) level through local county coordinators (LCC) working with local liaison groups (LLG) made up of farmers and representatives of partner organisations. Farmers' CFE activities involve paperwork. Initially these activities were recorded on-line on the CFE webpage.

There is a wide range of survey data being collected in the evaluation of the CFE (see e.g., Powell et al., 2012). The most recent data show that during the 2013/14 crop year, 44% of holdings in England had land within one of the 22 CFE-listed unpaid voluntary measures.

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[9] As explained by one of the farmers interviewed by Emery and Franks (2012): *"A lot of the schemes that come in you think 'well that's completely impractical, it's not going to work', if you actually had a farmer on the committee or something it would enable to stop that scheme happening before it even went down the road"*.

[10] Set-aside became compulsory in 1992 for large arable farmers as part of the MacSharry reform of the Common Agricultural Policy. It was originally set at 15% and reduced to 10% in 1996. Following the 2005 CAP reform this restriction was removed. Set-aside accounted for some 500,000 ha in England alone in 1995/1996, or to 11% of all eligible arable land (Firbank et al. 1998).

This totalled to 450 thousand hectares (with an additional 9800 skylark plots and 7400 km of fenced watercourses). Overall 38 % of holdings were not involved in any agro-environmental schemes in 2014. Given that an attribute of conservation management on farm land is that it involves some sacrifice of financial profit the CFE results strongly suggest other non-monetary motives.

Powell et al. (2012) discuss results from a survey with local county coordinators (LCCs) that asked for their views on what makes farmers get involved in the CFE. This resulted in four main categories of reasons that confirm the importance of peer pressure, the concern to be seen to be doing the right thing, and the influence of opinions of other farmers. The level of environmental interest was also clearly important. The interviewed LCCS indicated that the desire to avoid further regulation was a key reason some farmers were getting involved, while payments (from ELS) were a driving force for few farmers. Access to advice and learning what others are doing was seen as a more important factor.

The survey of the LCCs also investigated farmers' reasons for not getting involved in the CFE. A key reason was the financial and regulatory uncertainty due to the next (2015) CAP reform. Confusion over the message CFE is trying to achieve was also identified as a reason as well as the high cereal prices. But many LCCs indicated a general unwillingness among farmers to engage as a primary reason; i.e., avoiding form-filling and for some a desire to avoid more inspections, interference, and 'being told what to do' by outside agencies.

Interesting to note is the development in the area under unpaid measures since the start of the Campaign. There is a limited number of measures for which this can be analysed because CFE-listed unpaid practices have changed since 2009. From these survey data collected since 2011 it follows that overall areas have tended to fall with the exception of overwintering stubble and selective use of spring herbicides. Additional survey results suggest that the 2012/13 area of stubble was 93% (+/-25 %) higher than planned due to adverse weather conditions (Defra, 2013).

Thus the decrease in hectares suggests the interest in the CFA is waning but this does not necessarily mean a reduced interest in unpaid conservation per se. In the latter context it is interesting to note that in the farmer survey over 2012/13, 29% of the respondents in the same survey recorded land under some form of unpaid environmental management outside the Campaign that 'fully meets or closely resembles the essential management requirements' of CFE'. Obviously this is self-reported data but the 29% strikes as remarkable. It could mean that the CFA recognition has lost its honour effect since many farmers started participating. Alternatively it could mean that it is specific measures that create honour for the farmer and that these measures are not covered by the current CFA which has now less prescriptive requirements than at the start.

5. Concluding Remarks

Financial incentives are currently the most widely used instrument to enhance biodiversity, landscape quality (aesthetics, identity) and other agro-ecosystem services in European agricultural areas. The extant literature on farmer participation in agri-environmental schemes is substantial but in this context their (group) behaviour has gained limited attention. Little attention has been given to variation in pre-existing intrinsic motivation, how economic incentives induce changes in motivational structure and how this may affect conservation efforts. Of particular concern is that offering economic incentives to foster prosocial behavior can have crowding out effects of intrinsic motivation, reducing the total contribution.

We examined how endogenous social preferences—in particular, reputational concern conditional on social norm (i.e., average opinion regarding biodiversity protection on private land)—could affect standard economic incentive mechanism designto encourage biodiversity protection on private land. Behavioural economists have argued that protecting nature without compensation may increase a farmer's social reward, whereas when she protects biodiversity on her farmland only for the monetary reward, this social reward decreases – the classic *crowding out effect.* People, however, vary in social preferences and some farmers may engage in conservation activities merely to 'buy' a good social reputation rather than for the sake of the public good as such. The policy maker's dilemma is that of asymmetric information; he does not know the specific motivation to engage in the conservation activity of the individual farmer. We investigated an optimal voluntary incentive mechanism design that specifies a menu of monetary-transfer-to-effort that gets the best out of both types of farmers. Our results show that (a) social reward can induce the 'early birds' who used to be green even before other farmers undertake voluntary biodiversity protection on their land; and that (b) a decision maker can protect biodiversity on farmland at a lower cost by allowing farmers who are merely interested in social reputation to purchase a 'socially responsibility reward'.

Acknowledgement

This research was partially supported by FP7 Grant Agreement 282625, BIOMOT: MOTivational strength of ecosystem services and alternative ways to express the value of BIOdiversity.

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Figure 1

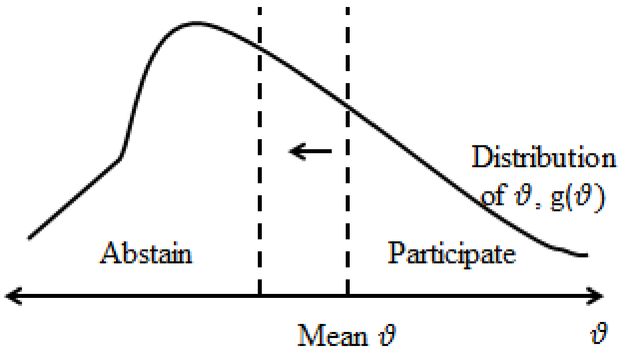

Figure 1 The density function of intrinsic satisfaction from doing the 'right thing'.