Do farmers follow the herd?
The influence of social norms on participation in agri-environmental schemes

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Abstract

The economic literature on Agri-environmental Schemes (AES) largely considers that farmers participate in contracts if the payment offered is superior to their opportunity costs. Psychological and social forces may however be at play in this decision. This article analyses the role played by social norms in farmers' decisions to enrol into AES. It develops a simple theoretical model highlighting the interplay of descriptive and injunctive norms in farmers' utility functions. Results of this model lead us to propose few policy recommendations to counter or, in other contexts, to take advantage of the influence of social norms to increase farmers' participation to AES.

Keywords agri-environmental contracts, social norms, behaviour
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Introduction

"No to technocratic ecology, yes to farmers' common sense" – this slogan chanted by French farmers during demonstrations reveals both a strong cultural resistance of the farming community to the growing weight of environmental objectives in agricultural policies and at the same time farmers' feelings that they have the skills and will to contribute to nature preservation. Yet, although there is increasing evidence that farmers' motivations for adopting pro-environmental farming practices are not exclusively driven by economic calculus, agri-environmental policies have not evolved to take this into account. Beyond compulsory greening, introduced in the 2014 CAP, the other dominant policy instrument is agri-environmental contracts in which farmers who voluntarily commit to adopt pro-environmental practices get payments compensating their costs and foregone profits. Several major agri-environmental policies rely on this approach: Agri-Environmental Schemes (AES) in Europe, different programs of Payment for Environmental Schemes (PES) implemented mainly in developing countries and the Environmental Quality Improvement Program (EQIP) in the United States[1].

The underlying assumption of these programs is that compensating farmers for the additional cost of adopting pro-environmental practices is sufficient to induce a change. However, in practice, it is observed that some farmers are reluctant to switch to new farming practices even when the payment level is above additional costs and income foregone (Kuhfuss *et al.*, 2014). This has resulted in limited participation rates especially in areas of intensive farming and in disappointing environmental outcomes (Dobbs and Pretty, 2008; Solagro, 2013).

Several hints indicate that social norms may be at play in the adoption of AES and pro-environmental practices. The importance of "roadside farming", describing how farmers observe each other's practices by the side of the road and how it influences their decisions, is often mentioned as a determinant of behaviour (Burton, 2004). According to some empirical work based on surveys, farmers' decision to adopt an AES is influenced by the opinion that other farmers have on AES (Defrancesco *et al.*, 2008). They are also more likely to participate if they live close to an area where the participation rate in AES is high (Allaire *et al.*, 2009). Other studies based on experimental approaches reveal that farmers are more likely to enrol into an AES or maintain their

[1] We will henceforth use the acronym AES as a generic term for these contracts.

pro-environmental practices at the end of the contract, when a large number of farmers do likewise (Chen *et al.*, 2009; Kuhfuss *et al.*, 2016). Besides, the role of social norms, sometimes referred to as social comparison or conditional cooperation, has been highlighted in the context of other pro-environmental behaviours, for example in the field of energy consumption (Allcott, 2011), water consumption (Ferraro *et al.*, 2011), curbside recycling (Schultz, 1999), littering (Cialdini *et al.*, 1990) and charitable contributions (Shang and Croson, 2009).
Despite the potential extensive role of social norms in the adoption of AES, this factor has been largely omitted in the way contracts and policies have been designed so far. This may partially explain the low participation of farmers in AES and their limited effectiveness. In this article, we intend to investigate how social norms influence the adoption of AES. This question raises theoretical issues to understand the effect of these norms on farmers' enrolment. Understanding the role of social norms is crucial, as interventions could be modified to harness the role of social norms or avoid their counterproductive effects. This should contribute ultimately to improve the effectiveness of agri-environmental programs.

This article is structured as follows. The first section explores the definitions of social norms and reviews the existing theoretical models that take into account the role of social norms in pro-social behaviour, with a focus on pro-environmental behaviour. Based on this review, we propose a theoretical model of the influence of social norms on the adoption of AES in section 2. We then present in section 3 the policy implications of our model.

1 Literature review on social norms

The influence of social norms on individual decisions has been only recently investigated in economic theory. In order to analyse the influence of social norms on farmers' enrolment in AES, we first explore the contributions of social-psychology on the definitions of social norm and how they influence human behaviour. We then briefly review the existing economic models which include social norms.

1.1 Different types of social norms

Social norms describe how individual actions are influenced by the behaviour or opinions of others. These actions are either prescribed or proscribed, *"don't do or do X"* (Elster, 1989). They are a kind of informal law system implemented at the level of a group (Cialdini and Trost, 1998). Bicchieri (2006) considers that social norms "refer to behaviour, to actions over which people have control, and are supported by shared expectations about what should/should not be done in different types of social situations". This definition introduces three important concepts. First, norms can only exist when there are common expectations about the appropriate behaviour. If these expectations are not sufficiently widespread, they cannot gain the status of norms. They require a certain form of consensus. In Bicchieri's views, social norms are "the unintentional and unplanned outcome of human interaction". Second, being based on expectations, these norms are subjective and go through the prism of perceptions. Third, different norms apply to different contexts, they are context dependent. In other words, norms specify the most socially appropriate action in a particular context (Kimbrough and Vostroknutov, 2013).

Cialdini *et al.* (1990) propose a division of social norms, subsequently taken up by many authors: the descriptive norm and the injunctive norm. The descriptive norm is what is typical or normal, i.e. what most people do. It mainly provides information about what will likely be an effective action "if everyone is doing it, it must be a sensible thing to do". It provides an information advantage and a decision shortcut when choosing to behave in a given situation. The injunctive norm refers to what constitutes morally approved and disapproved conduct, *i.e.* what ought to be done. Injunctive norms influence people because they are the promise of social sanctions/rewards. Because actions that are approved are often the ones that are observed, there is often confusion between the two. Although both norms may influence behaviour, they are not in force at all times and in all situations. Norms need to be activated in order to have an effect and this requires the norm to be made salient, *i.e.* attention needs to be focused on this particular norm. In presence of conflicting norms, the influential norm is the most salient one in a given situation (Cialdini *et al.*, 1990).

Bicchieri (2006) proposes a slightly different vision. She argues that two types of expectations are involved in social norms: empirical expectations, or what we believe others do (a sort of subjective descriptive norm), and normative expectations, what we believe others think ought to be done (a sort of subjective injunctive norm). People have conditional preference for fulfilling the norm, provided empirical expectations and normative expectations are met. In other words, people would prefer to follow a social norm on condition that (a) they expect others to follow it and (b) they believe that, in turn, they are expected by others to follow the norm. If these two conditions are not simultaneously present, there is not really a social norm.

1.2 Theoretical modelling of social norms

Social norms have been modelled in different ways in the literature. Lindbeck *et al.*(1999) consider a social norm as a stigma for carrying out an antisocial activity (a negative payoff) that decreases with the number of people infringing it. Rege (2004) considers that people who do not carry out pro-environmental activities are disapproved if they meet someone who does it but they have less chance to meet them than someone with the same behaviour. Nyborg et al. (2006) propose a model of "socially contingent moral motivation", in which individuals feel an obligation to contribute to a public good when they perceive that others also take responsibility for providing the public good. In other words, individuals' moral payoff associated to their pro-environmental behaviour increases with the adoption rate of this behaviour in the population. Benabou and Tirole (2012) propose a different approach, based on a social signalling model, bringing together the feeling of distinctness (individual behaviours are substitutes) and conformity (individual behaviours are complements, as usually modelled on social norms).

In these models, the descriptive norm is generally considered only as an increasing function of the adoption rate of a pro-social activity, i.e. support for the adoption of this pro-social activity is weak when few people behave pro-socially and strong when such behaviour becomes more prevalent in the population. The existence of conservative forces urging people not to undertake pro-social activities, when few people do so, is generally not considered. We believe that such forces may be at work in farming communities, explaining in some cases the low diffusion of pro-environmental commitments. Indeed, innovative farmers who first adopt more environmentally friendly practices, demonstrating that such practices are technically and economically feasible are sometimes disapproved and even stigmatized in the farming community.

Another aspect of the role of social norms, which is not well captured by models, is the way the injunctive norm is formed and subsequently influences behaviour. There is very little information in the literature providing hints on how the general opinion on what should be done is formed and therefore how it could be modelled.

In the subsequent section, we will intend to integrate these aspects - the negative effect of the descriptive norm in situations of low adoption and a mechanism of formation of the injunctive norm - in a model of adoption of AES.

2 Modelling the effect of social norms on the adoption of AES

In this model, we study farmers' enrolment in AES in the presence of an injunctive and a descriptive norm.

2.1 Theoretical framework

We consider a continuum $[0,1]$ of identical farmers. Each farmer $i \in [0,1]$ has to decide either to participate in AES ($e_i = 1$) or not ($e_i = 0$). Enrolment in AES corresponds to a contribution of a fixed amount, $e_i = 1$, to a public good that benefits the whole society.

Let x denote the share of enrolled farmers in AES, $x \in [0,1]$. Since there is a continuum of farmers, we consider that a farmer i's enrolment has no effect on the average provision of public good, $\bar{e} = x$. In other words, we consider a context in which the individual farmer does not perceive the benefits of his individual contribution. As in Rege (2004), the strategic aspect of the public good game is therefore not taken into account in this model.

To represent farmer i's preferences without taking into account the influence of social norms, we use the simplest specification:

$$U_i = (p - c)e_i + \beta\bar{e}$$

with c the cost to enrol in AES, p the AES payment and β the farmer's private benefit derived from the average provision of the public good, $\bar{e}$.

The difference in farmer i's utility between enrolling and not enrolling in AES is given by:

$$\Delta U = U_i^1 - U_i^0 = p - c$$

Farmers enrol in AES only if $\Delta U > 0$.

Result 1: *Without social norms, farmers enrol in AES if and only if* $p > c$.

2.2 Descriptive norm

We propose to specify the utility gains or losses associated with the conformity to the social descriptive norm u_{DN} with the following specification:

$$u_{DN} = (2e_i - 1)(2x - 1)$$

This specification reflects the fact that individuals perceive a utility (disutility) when they conform (do not conform) to the descriptive norm. As shown in Figure 1, if the farmer does not enrol in AES ($e_i = 0$), he gets a positive utility from acting like all other farmers if $x = 0$. But his utility decreases as x increases and becomes negative when the majority of farmers enrols in AES, *i.e.* when $x > \frac{1}{2}$. If the farmer enrols in AES ($e_i = 1$), his utility from not conforming to the descriptive norm is negative when $x = 0$, but increases with x and becomes positive as soon as the majority of farmers acts like him, i.e. $x > \frac{1}{2}$.

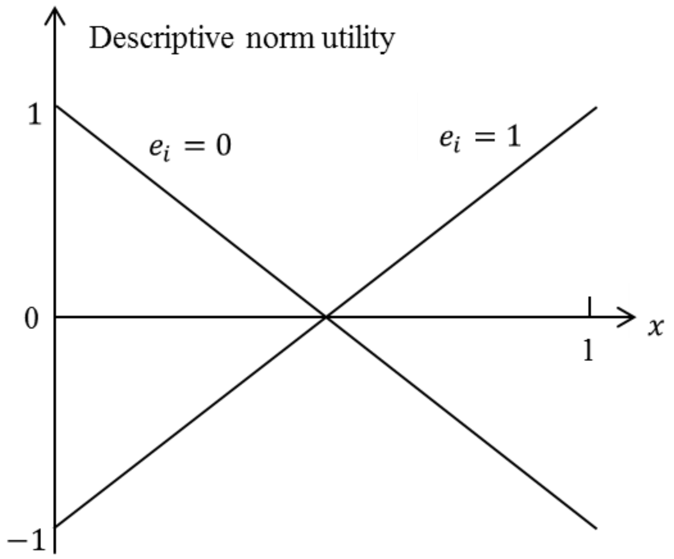

Figure 1: Utility derived from the level of conformity with the descriptive norm

This specification entails that the descriptive norm is not only exerted by people who adopt a pro-social behaviour but also by people who don't. Contrary to Rege (2004) who assumes that a non-contributor only feels disapproval, this novel approach intends to reflect the observed resistance of farmers to participate in pro-environmental policies when most farmers don't.

With this descriptive norm specification, farmer i's utility is:

$$U_i = (p - c)e_i + \beta\bar{e} + \lambda(2e_i - 1)(2x - 1)$$

$$\Delta U = p - c + 2\lambda(2x - 1)$$

λ is a scale parameter: it can be interpreted as the weight of the descriptive norm in the utility function of farmers; or alternatively as the salience of the descriptive norm.

Let x' be defined by $\Delta U = 0$, $x' = \frac{1}{2} - \frac{p-c}{4\lambda}$

Result 2:

- *The game has a Nash equilibrium in which every farmer enrols in AES if and only if* $p \geq c - 2\lambda$.
- *The game has a Nash equilibrium in which no farmer enrols in AES if and only if* $p \leq c + 2\lambda$.

- *The game has a Nash equilibrium in which a share x' of farmers enrol in AES if and only if $c - 2\lambda < p < c + 2\lambda$.*

Proof: $\Delta U = 0$ if and only if $x = x'$. Note that ΔU is an increasing function of x. Thus $\Delta U \geq 0$ if and only if $x \geq x'$ and $\Delta U \leq 0$ if and only if $x \leq x'$.

Furthermore, note that $x' \leq 1$ if and only if $p \geq c - 2\lambda$. If $x = 1$, farmer i choosing $e_i = 1$ will not deviate unilaterally from his choice because $\Delta U \geq 0$. Thus, $e_i = 1$ for all i is a Nash equilibrium (NE e=1) if and only if $p \geq c - 2\lambda$

In the same way, note that $x' \geq 0$ if and only if $p \leq c + 2\lambda$. If $x = 0$, farmer i choosing $e_i = 0$ will not deviate unilaterally because $\Delta U \leq 0$. Thus $e_i = 0$ for all i is a Nash equilibrium (NE e=0) if and only if $p \leq c + 2\lambda$,

$e_i = 1$ for a share x' of farmers enrolling in AES is also a Nash equilibrium (NE e=x') if and only if $c - 2\lambda \leq p \leq c + 2\lambda$.

Figure 2 presents the conditions on p for the existence of the Nash Equilibrium.

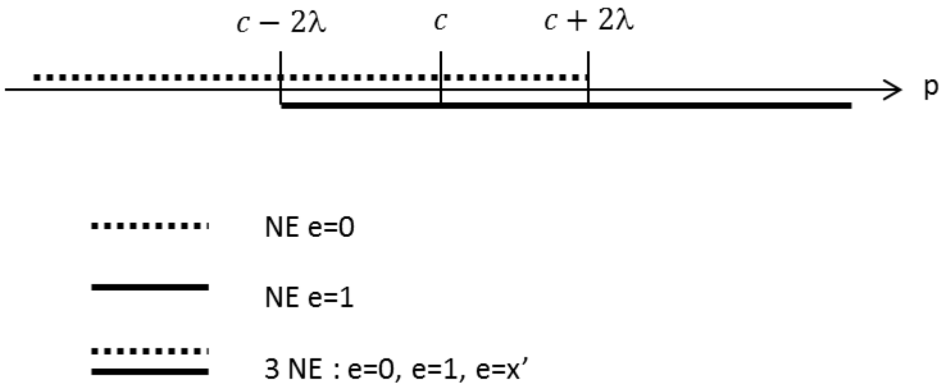

Figure 2: Nash equilibria with the descriptive norm in relation with the value of p

Corollary: $p > c$ is no longer a sufficient condition for farmer i to enrol in AES (when enrolment rate is low), nor $p < c$ a sufficient condition for farmer i not to enrol in AES (when enrolment rate is high).

$p > c + 2\lambda$ is a necessary and sufficient condition to have a single Nash equilibrium in which all farmers enrol in AES.

$p < c - 2\lambda$ is a necessary and sufficient condition to have a single Nash equilibrium in which no farmer enrols in AES.

Result 2 implies that when we include descriptive norms in the model, we obtain a coordination game if $c - 2\lambda < p < c + 2\lambda$. In this case, the game has three Nash equilibria; one in which every farmer enrols in AES, one in which no farmer enrols and one in which a share x' enrol in AES.

However, the game has only two asymptotically stable states ($x = 0$ and $x = 1$) as shown in Figure 3. Indeed, the mixed Nash equilibrium is not an asymptotically stable state in an evolutionary game setting. See Appendix A for a formal proof.

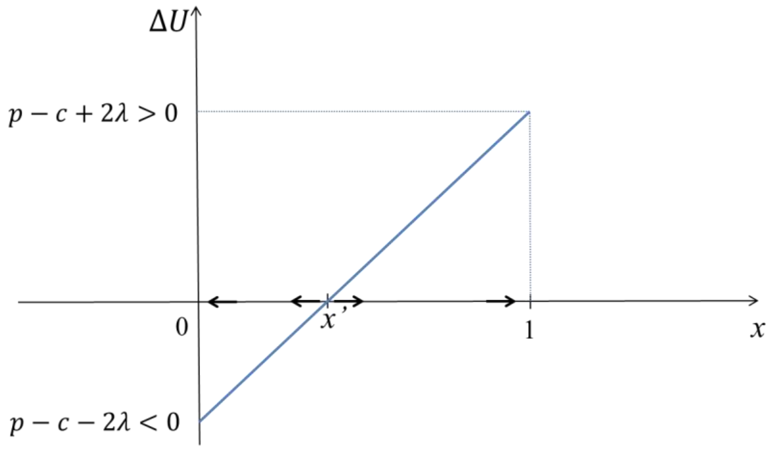

Figure 3: Difference in farmer i's utility in the coordination game when c-2λ<p<c+2λ

This model illustrates that the descriptive norm can be an obstacle in the early phases of implementation of an AES programme. In the conditions where the three equilibria are possible ($c - 2\lambda < p < c + 2\lambda$), unless participation reaches a minimum threshold (x'), the descriptive norm is an impeding factor for enrolment. Only when a minimum level of participation is reached (x') does the descriptive norm reinforce farmers' enrolment rate.

2.3 Injunctive norm

Two features characterize the role played by injunctive norms in farmers' enrolment into AES. First, we assume that this injunctive norm comes from the whole society: farmers but also and mainly non-farmers. This specification is an innovation as injunctive norms are generally considered to be exerted by peers exclusively. However, a preliminary survey on AES adoption revealed that people who seem to have an influential opinion are not neighbour farmers but rather other members of the society such as spouses and farm advisors (Le Coent, 2016). Second, we assume that the injunctive norm is exerted more strongly when the level of the environmental public good $\bar{e}$ is low. Indeed, when no farmer is enrolled in AES, the level of the environmental public good is at its lowest level. It is usually when the society strongly urges farmers to change their practices and to enrol in AES. However, as the state of the environment improves, *i.e.* the provision of public good increases, the injunction to enrol in AES weakens. Contrary to the descriptive norm, the injunctive norm is a driving force for enrolment when few farmers participate. However, when AES uptake increases, the injunctive norm plays a lesser role. This model specification is original because the injunctive and social norms are generally considered to be congruent since "what is approved is often what is typically done" (Cialdini *et al.* 1990). In our case, descriptive and injunctive norms pull in two opposite directions when adoption rate is low.

Assume that conforming to the injunctive norm yields the following (dis)utility u_{IN}, which takes the following specification:

$$u_{IN} = \frac{2e_i - 1}{\bar{e} + 1} = \frac{2e_i - 1}{x + 1}$$

This specification reflects the fact that farmers perceive a utility (disutility) when they conform (do not conform) to the injunctive norm which decreases as x increases. If the farmer does not enrol in AES ($e_i = 0$), he feels social disapproval. Disapproval decreases as the enrolment rate (and therefore the provision of public good) increases. Alternatively, if the farmer enrols when no-one else does so, he feels social approval ($e_i = 1$). But social approval decreases as x increases (Figure 4).

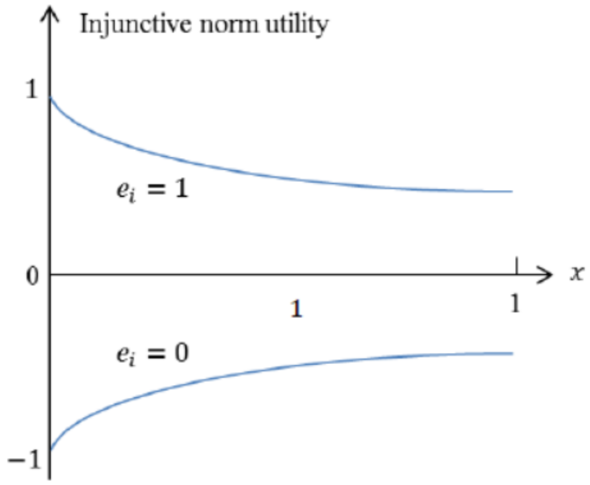

Figure 4: Utility derived from the level of conformity with the injunctive norm

With this injunctive norm specification, farmer i's utility is:

$$U_i = (p - c)e_i + \beta\bar{e} + \sigma\frac{2e_i - 1}{x + 1}$$

$$\Delta U = p - c + \frac{2\sigma}{x + 1}$$

with σ a scale parameter for the injunctive norm reflecting the weight of the injunctive norm into the total utility or its salience.

Let x' be defined by $\Delta U = 0$.

Result 3:

- *The game has a Nash equilibrium in which every farmer enrols in AES if and only if* $p \geq c - \sigma$.
- *The game has a Nash equilibrium in which no farmer enrols in AES if and only if* $p \leq c - 2\sigma$.
- *The game has a Nash equilibrium in which a share* x' *of farmers enrol in AES if and only if* $c - 2\sigma < p < c - \sigma$.

Proof: As illustrated in Figure 5, note that ΔU is monotonously decreasing in x on $[0,1]$. Thus, $e_i = 1$ for all i is a Nash equilibrium if and only if $\Delta U > 0$ when $x = 1$, *i.e.* if and only if $p > c -$

σ. Then, $e_i = 0$ for all i is a Nash equilibrium if and only if $\Delta U < 0$ when $x = 0$, *i.e.* if and only if $p < c - 2\sigma$. Finally, $e_i = 1$ for a share $x' = -\frac{2\sigma}{p-c} - 1$ of farmers enrol in AES if and only if $c - 2\sigma \leq p \leq c - \sigma$. The three Nash equilibria in relation to the value of p are presented in Figure 6.

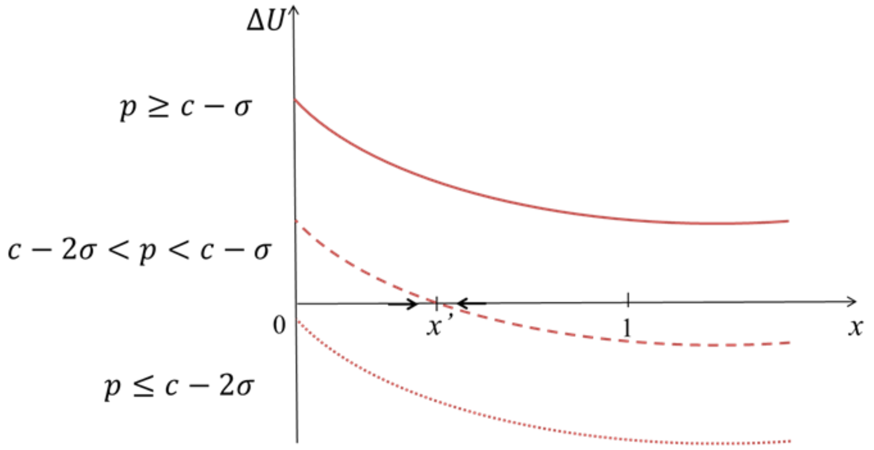

Figure 5: Difference in farmer i's utility in the three cases according to the value of p compared to $c - 2\sigma$ and $c - \sigma$

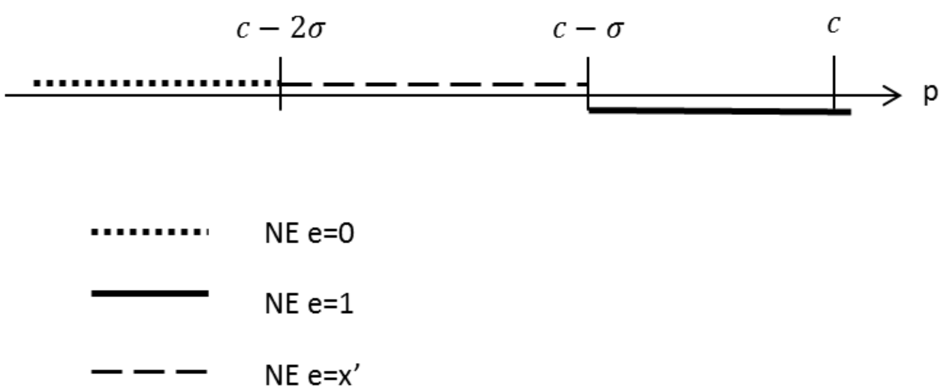

Figure 6: Nash equilibria with the injunctive norm in relation with the value of p

Corollary: As defined here, the injunctive norm shall only have a positive impact on enrolment. $p < c$ is no longer a sufficient condition for farmers not to enrol in AES as the injunctive norm effect (social approval vs social disapproval) may compensate a payment which might be lower than the cost of enrolment.

Contrary to Result 2 for the model with the descriptive norm, Result 3 shows that the game is not a coordination game. Indeed, the necessary and sufficient conditions for each Nash equilibrium do not overlap with each other (Figure 5). Thus we do not need to refer to an evolutionary analysis to confirm that the three Nash equilibria are the three asymptotically stable states of this game.

2.4 Combining descriptive and injunctive norms

Combining descriptive and injunctive norms in farmer i's utility gives:

$$U_i = (p - c)e_i + \beta\bar{e} + \lambda(2e_i - 1)(2x - 1) + \sigma\frac{2e_i - 1}{x + 1}$$

$$\Delta U = p - c + 2\lambda(2x - 1) + \frac{2\sigma}{x + 1}$$

$\frac{d\Delta U}{dx} = 0$ if $x = \hat{x} = \sqrt{\frac{\sigma}{2\lambda}} - 1$.

ΔU is decreasing if and only if $x < \hat{x}$ and ΔU is increasing if and only if $x > \hat{x}$

Let ΔU_{min} be ΔU when $x = \hat{x}$.

This more complex specification leads to different cases depending whether:

- $\hat{x} \leq 0$ (case 1), if and only if $\sigma \leq 2\lambda$
- $0 < \hat{x} < 1$ (case 2) if and only if $2\lambda < \sigma < 8\lambda$ or
- $\hat{x} \geq 1$ (case 3) if and only if $\sigma \geq 8\lambda$.

Falling into one case or another therefore only depends on the relative weight that farmers grant to the descriptive norm (λ) and the subjective norm (σ) *i.e.* the relative strengths of the descriptive and the injunctive norms.

Each of these three cases has three or five subcases (see Appendix B for a description of each subcase).

One interesting case is the case 2 in which λ and σ are relatively similar. The subcase 2b) is particularly challenging because it presents three Nash equilibria: two in which only a share of the population enrols in the AES (x' and x'') and one in which everybody enrols. However there are only two asymptotically stable states in this coordination game: $x = x'$ and $x = 1$ This case is presented in Figure 7.

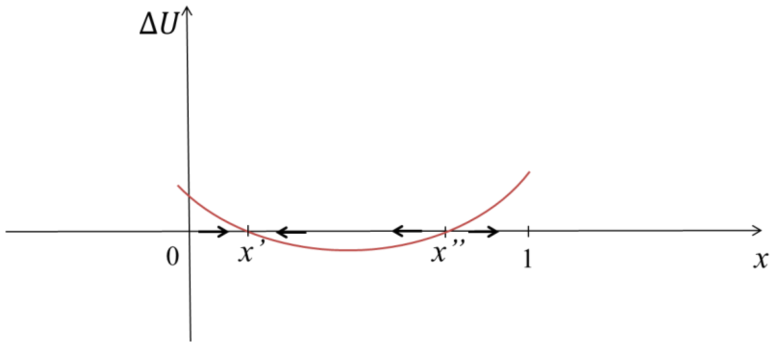

Figure 7: Utility variation for subcase 2b)

A first level of participation x' can be attained, mainly thanks to the effect of the injunctive norm. However, beyond that point, only if the participation rate reaches a level superior to x'' can the descriptive norm guarantee a significant improvement in enrolment, up to full participation.

This subcase could describe the situation observed in many areas where AES have been introduced and their adoption rates remain limited. Thanks to contract payments and under the effect of injunctive norms, the first equilibrium may be attained. However, the descriptive norm influences adoption negatively, and does not allow to improve participation into AES significantly.

Our model provides insights on the isolated and combined effects of the descriptive and injunctive social norms on the adoption of AES. The model reveals that different situations are possible depending on the relative weight or salience of the norm: λ and σ. We use the predictions of the model to draw policy implications to improve AES adoption.

3 Conclusion and policy recommendations

This paper analyses theoretically the influence of social norms on the adoption of agri-environmental schemes. More precisely, our model analyses the interplay between two types of social norms which sometimes play in opposite directions. Whereas the injunctive norm tends to push the AES enrolment rate upwards, but with decreasing marginal efficiency, descriptive norms can have a counteracting effect, when the proportion of enrolled farmers is low. Thus the expectation that social norms activation fosters pro-social behaviour and therefore yields greater levels of public good provision for lower economic incentives (the so-called multiplier effect of social norms) is not always verified.

We indeed show that the relative weights of injunctive and descriptive norms in farmers' preferences can induce different types of collective behaviour. When the weight of the descriptive norm λ is large relative to the weight of the injunctive norm σ, the two stable Nash equilibria are either no participation or full participation. When the weight of the descriptive norm λ is smaller relative to the weight of the injunctive norm σ, we also identify cases in which the population might be trapped in a stable low participation equilibrium.

Identifying the relative weight of the descriptive and injunctive norm in the decision to participate in AES in different contexts remains an empirical question. Several approaches could be used to estimate these weights. Field experiments are increasingly used to estimate the influence of different behavioural factors on human decisions (Allcott, 2011; Ferraro *et al.*, 2011; Schultz, 1999; Cialdini *et al.*, 1990; Shang and Croson, 2009). These approaches have the advantage to estimate a robust causality link between the behavioural factor and the studied outcome. They however usually estimate the different behavioural factors in isolation and require the introduction of an exogenous variation of the norm to estimate the impact on the studied behaviour, which is particularly difficult in this context. Modifying experimentally the number of farmers who adopt an AES and the perception of the injunctive norm to adopt an AES would indeed be an experimental challenge. Another approach would be to use lab-in-the field experiments with farmers to estimate the relative importance of injunctive and descriptive norm in decontextualized experiments. Although this approach may have a high internal validity, it is uncertain whether the values of λ and σ determined with such experiments may actually apply in the decision to participate in AES. Finally, social psychology has developed methods based on surveys, such as the Theory of Planned Behavior (Ajzen, 1991), to estimate the influence of a number of motivations, including social norms, in the decision to adopt pro-environmental behaviour. The estimation of the role of these factors is however largely plagued with weak econometric identification strategy.

Despite the difficulty to identify empirically the importance of these norms, some policy recommendations can be drawn from our theoretical approach. First, moving from low participation equilibrium may be obtained by playing on the levels of net payments *p-c*. The use of a dynamic payment system may be particularly relevant. For example, the regulator could offer a high payment rate at the start of the programme, to boost enrolment and to bring overall participation rate beyond the high equilibrium point. Once this threshold participation level is reached, he can then reduce the payment for new entrants since the strength of the descriptive norm combined with the injunctive norm will henceforth be sufficient to ensure full participation. This two-tier payment can be efficient whilst at the same time limit budget expenditures.

Another policy option is to influence the relative values of λ and σ. Indeed, these parameters also capture the salience and visibility of social norms. The more salient a social norm, the greater its weight in the utility function. If a communication campaign promotes the necessity to reduce the use of pesticides because of their impact on nature and health, it may contribute to reinforce the scope of the injunctive norm and therefore the value of σ relative to λ, thus increasing the chances to land on a stable high (or full) participation equilibrium.

Another approach would be to strengthen communication on the adoption rate of other farmers and/or the opinion of other farmers during the period when farmers have to decide to sign or not. The experiment carried out by Kuhfuss *et al* (2016) shows the positive impact of revealing information on other farmers' decision on the maintenance of pro-environmental practices at the end of an AES contract, when the adoption rates communicated are high enough. Our model however shows that revealing this information may be counterproductive when adoption rates are low, because the descriptive norm actually limits adoption in this context.

The use of communication campaigns (Benabou and Tirole, 2012; Nyborg *et al.*, 2006) must also be considered with care. Communication messages are often targeted at norm misperceptions. "*Lifting the veil*" (Bicchieri, 2006), *i.e.* modifying the perception of the norm, is indeed much easier than modifying the norm itself. Different policies may be necessary depending on the type of misperception. The example of campaign aiming at correcting these misperceptions in order to reduce alcohol overuse is a famous example of effective social norms campaigns (Schroeder and Prentice, 1998). The credibility of social norm communication campaigns is however problematic when the regulator decides to disclose the information that he finds most suitable to obtain the expected result. Examples of failure of social norm campaigns which misreported data or used data considered unreliable by the target population are reported in Berkowitz (2004).

A final alternative intervention would be to modify AES payments in a way that would modify beliefs on the behaviour of others and thus the perceived descriptive norm. Conditioning the payment of AES to a minimum level of farmers' participation could indeed increase participation through the modification of beliefs on the behaviour of others (Le Coent *et al.*, 2015). Kuhfuss *et al* (2016) demonstrate that a greater enrolment rate can be obtained for lower payments, by conditioning only a portion of the payment to a threshold of participation.

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APPENDIX A

Following Rege (2014), we use the replicator dynamics to represent a "virtual" learning process of trial-and error.

"*The replicator dynamics say that the growth rate of the population share using a certain strategy equals the difference between the strategy's current payoff and the current average payoff in the population (Weibull, 1995, p. 73).*"

In our case, the replicator dynamics is given by:

$$\dot{x}(x) = x(U_i^1(x) - \bar{U}(x))$$

Where $\bar{U}(x) = xU_i^1(x) + (1-x)U_i^0(x)$

$$\dot{x}(x) = x(1-x)\Delta U(x)$$
$$\dot{x}(x) = x(1-x)[p - c + 2\lambda(2x-1)]$$

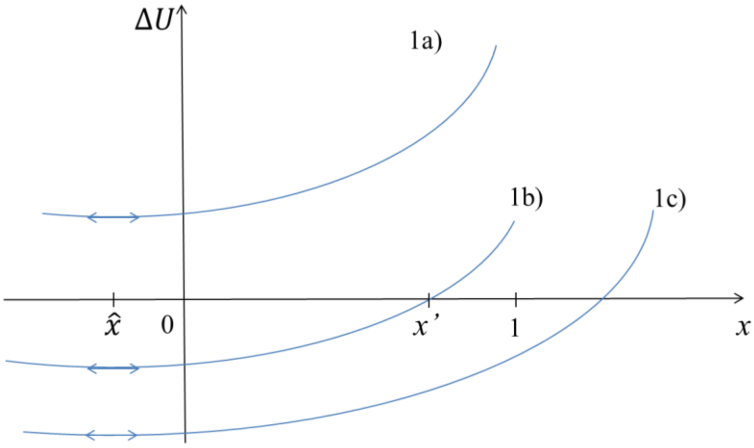
Stationary states are determined by $\dot{x}(x) = 0$. Thus, there are three stationary states: $x = 0, x = 1$ and $x = x' = \frac{1}{2} - \frac{p-c}{4\lambda}$.

For $0 < x < 1$, $\dot{x} > 0$ if $\Delta U = p - c + 2\lambda(2x-1) > 0$ and thus if and only if $x > \frac{1}{2} - \frac{p-c}{4\lambda} = x'$. Symmetrically, for $0 < x < 1$, $\dot{x} < 0$ if $\Delta U = p - c + 2\lambda(2x-1) < 0$ and thus if and only if $x < \frac{1}{2} - \frac{p-c}{4\lambda} = x'$. Hence, $x = x'$ is not an asymptotically stable state because if the share of farmers who enrol in AES moves above $max\{0, x'\}$, then $x > x'$ and $\Delta U > 0$. Therefore, more farmers will enrol in AES. This process will continue until all farmers are enrolled and the asymptotically stable state $x = 1$ is reached. Symmetrically, if the share of farmers who enrol in AES moves below $min\{1, x'\}$, then more farmers will quit the AES. This process will continue until all farmers leave the AES and the asymptotically stable state $x = 0$ is reached.

APPENDIX B

Case 1: $\hat{x} \leq 0 \quad \Leftrightarrow \quad \sigma \leq 2\lambda$

The weight of the injunctive norm is not too strong relatively to the weight of the descriptive norm. In this first case ΔU is always increasing on $x \in [0,1]$ and there are 3 subcases:



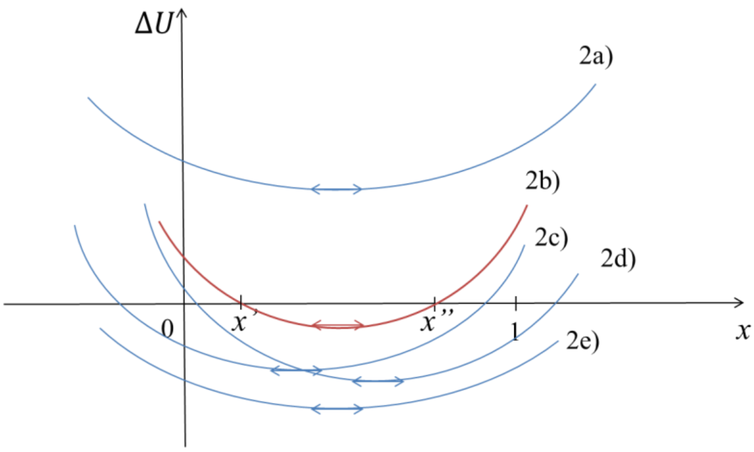
1a) If $\Delta U > 0$ when $x = 0$ then $\Delta U > 0\ \forall x \in [0,1]$. Thus there is a unique Nash equilibrium in which all farmers enrol in AES ($x = 1$).

1b) If $\Delta U < 0$ when $x = 0$ and $\Delta U > 0$ when $x = 1$ then there is a unique $x' \in [0,1]$ such that $\Delta U(x') = 0$. In that case there are three Nash equilibria: $x = 0$, $x = 1$ and $x = x'$. However there are only two asymptotically stable states $x = 0$ and $x = 1$.

1c) If $\Delta U < 0$ when $x = 1$ then $\Delta U < 0\ \forall x \in [0,1]$ thus there is a unique Nash equilibrium in which no farmer enrols in AES ($x = 0$).

Case 2: $0 < \hat{x} < 1 \Leftrightarrow 2\lambda < \sigma < 8\lambda$

The weight of the injunctive norm is not too strong and not too weak relatively to the weight of the descriptive norm. In this second case, ΔU is first decreasing until $\hat{x}$ and then increasing. There are 5 subcases:



2a) If $\Delta U_{min} > 0$ then $\Delta U > 0\ \forall x \in [0,1]$ thus there is a unique Nash equilibrium in which all farmers enrol in AES ($x = 1$).

2b) If $\Delta U_{min} \leq 0$ and $\Delta U > 0$ when $x = 0$ and $\Delta U > 0$ when $x = 1$ then there are two $x \in [0,1]$ (x' and $x"$) such that $\Delta U(x') = \Delta U(x") = 0$. In that case, there are three Nash equilibria: $x = x'$, $x = x"$ and $x = 1$. However there are only two asymptotically stable states in this coordination game: $x = x'$ and $x = 1$.

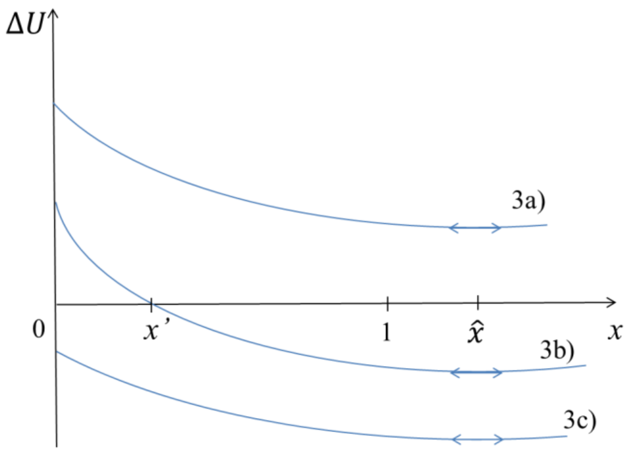
2c) If $\Delta U_{min} \leq 0$ and $\Delta U < 0$ when $x = 0$ and $\Delta U > 0$ when $x = 1$ then there is a unique $x' \in [0,1]$ such that $\Delta U(x') = 0$. In that case there are three Nash equilibria: $x = 0$, $x = 1$ and $x = x'$. However there are only two asymptotically stable states $x = 0$ and $x = 1$.

2d) If $\Delta U_{min} \leq 0$ and $\Delta U > 0$ when $x = 0$ and $\Delta U < 0$ when $x = 1$ then there is a unique $x' \in [0,1]$ such that $\Delta U(x') = 0$. In that case there is a unique Nash equilibria: $x = x'$.

2e) If $\Delta U_{min} \leq 0$ and $\Delta U < 0$ when $x = 0$ and $\Delta U < 0$ when $x = 1$ then $\Delta U < 0$ $\forall x \in [0,1]$ thus there is a unique Nash equilibrium in which no farmer enrols in AES ($x = 0$).

Case 3: $\hat{x} \geq 1 \quad \Leftrightarrow \quad \sigma \geq 8\lambda$

The weight of the injunctive norm is strong relatively to the weight of the descriptive norm. In this last case ΔU is always decreasing and there are 3 subcases:



3a) If $\Delta U > 0$ when $x = 1$ then $\Delta U > 0$ $\forall x \in [0,1]$ thus there is a unique Nash equilibrium in which all farmers enrol in AES ($x = 1$).

3b) If $\Delta U > 0$ when $x = 0$ and $\Delta U < 0$ when $x = 1$ then there is a unique $x' \in [0,1]$ such that $\Delta U(x') = 0$. In that case there is a unique Nash equilibria: $x = x'$.

3c) If $\Delta U < 0$ when $x = 0$ then $\Delta U < 0$ $\forall x \in [0,1]$ thus there is a unique Nash equilibrium in which no farmer enrols in AES ($x = 0$).