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Why do farmers behave as they do? Understanding compliance with rural, agricultural, and food attribute standards

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Why do farmers behave as they do? Understanding compliance with rural, agricultural, and food attribute standards

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Abstract

Agricultural production experiences a shift in underlying institutions during the last years. The importance of private stakeholders like retailers, processors, consumers as well as tax payers is emerging. Eligibility for single farm payments and marketing of products is linked to compliance with diverse codes of practice and standards. Voluntary certification schemes are not only relevant with respect to agriculture's traditional activity (i.e. food production), but are also highly relevant in the case of rural policies. Examples are the EU's agri-environmental schemes, aimed at preserving biodiversity, landscape elements, etc., which are characterized by voluntary participation and the contractual commitment to apply certain standards. These relationships, however, are characterized by strong information asymmetries. Economic literature offers several approaches to analyse similar relations. The classical approach is based on the assumption of utility maximising agents that will comply with rules as long as the net utility of compliance will be higher than the net utility of an offence. Recent evidence challenges this result. Experiments show that people behave more honestly than the classical deterrence model predicts. The main objective of the paper is to compare the various approaches to explain compliant behaviour. Additionally, an outlook for empirical applications of the theoretical framework developed here is given to motivate further research. However, our outlook shows that the selection of appropriate variables to analyse compliance empirically is open to debate.

Keywords: regulation, cross-compliance, quality standards, compliant behaviour

Theories of choice are at best approximate and incomplete.

(Tversky and Kahneman, 1992; p. 317)

Introduction

Agricultural production currently faces a fundamental shift in underlying constraints. Farmers have to adapt themselves not only to changed price signals, but also to a new institutional arrangement giving agriculture its proper place in society. An example is the current debate on the reform of the Common Agricultural Policy, which emphasizes the need to make agriculture more sustainable and improve its role in the provision of public goods. Whereas this often implies making increased use of regulatory measures affecting land management, the literature is rather silent on the issue of compliance with such regulations. However, compliance might be crucial for the effectiveness of the regulations with respect to achieving the specified policy objectives. Another development is that judicial regulations are increasingly strengthened by privately agreed regulations or contractual arrangements. Even more important, those regulations and arrangements often exhibit a quasi-mandatory character. Examples are obligatory and voluntary cross-compliance, the EU's agri-environmental schemes--i.e. voluntary standards aimed at preserving biodiversity and landscape element--and privately initiated food quality standards or Quality Assurance Schemes (QAS). All these domains were previously exclusively governed by European commission's Directives and Regulations as well as national laws on the environment, health and food safety. They should guarantee an equal level of environmental protection and consumer's health within the European Union and at the same time give the producers economic freedom as how to satisfy the statutory targets.

Two institutional developments over the recent decades introduced a greater variety of production conditions within the EU. Starting with the introduction of voluntary programs, like the agri-environmental schemes (AES) in the late 1980s, participating farmers face

additional constraints on production or changed incentives to comply to existing regulations from a policy perspective. With the introduction of compulsory cross-compliance regulations with the 2003 CAP reform (Regulation 1782/2003), agricultural policy provides an additional enforcement system beside existing legislation. More specifically, then about five million EU farmers have to comply with 19 pre-existing legislative acts, also called Statutory Management Requirements (SMR), and a number of standards ensuring good agricultural and environmental condition of agricultural land (GAEC) to be qualified for the Single Farm Payment (SFP).

Beyond these minimum requirements each Member State has put in place several AES which entitle farmers to additional compensations. Main focus of this instrument mix is to reach environment, biodiversity, food safety, animal welfare and soil conservation related goals. Turning from policy to new institutions invented by trading partners, beside established processor-specific standards in the framework of contract agriculture, food retailers and processors set up standards of Good Agricultural Practices at the end of the 1990s. These standards define food safety, animal health and welfare, environmental and land use requirements (e.g. soil erosion). However, some of them operate to 'baseline' standards, i.e. close to minimum legal requirements, and others extend far beyond legal requirements. The majority of them have only limited regional or national relevance. However, it seems that a minority relate to a standard of global relevance (e.g. GlobalGAP, British Retail Consortium Global Standard Food). Farmers can, theoretically, freely decide to adopt those standards. But it is quite reasonable to assume that with an increasing range of standards, they will develop a quasi-mandatory nature, at least indirectly or for larger farmers. For instance, 90 per cent of the pig meat traded in the Netherlands satisfies the IKB-Pig standard. Meat not having this standard will face obstacles hindering smooth trade. For milk the Dutch dairy farmer's participation in the KKM quality standard is even close to 100 per cent (Jongeneel, 2006).

Moreover in the UK, today, the most dominant of the quality assurance schemes (in terms of market share) are those which come under the umbrella of Assured Food Standards (AFS), well-known because of the ‘Little Red Tractor’ logo, a registered trademark (Farmer et al., 2007, p. 24).

Economic analysis of these new institutions¹ regard usually the costs and benefits of regulations. A full evaluation and measurement of these costs and benefits (welfare impact assessment) involves great difficulties in practice and is beyond the scope of this paper (for a discussion, see Gardner (2003). But one central element of the effectiveness of regulations is a farmer’s behaviour. Farmers can (or have to) adopt the new requirements. However, they do not necessarily adjust their input and output mix to mitigate the impacts of the regulation. Thus, compliance with the imposed regulations/ standards is a critical issue. Non-compliance at a large scale might undermine the acceptance of regulations or even provoke their complete failure. Due to its uniform nature of the described regulations for every farmer, the optimal design of several types of regulations for heterogeneous set of farmers from a regulator’s perspective is neglected here (see for instance Moxey et al., 1999; Hart and Latacz-Lohmann, 2005). Furthermore, a rich body of literature analyses the voluntary adoption of agri-environmental schemes (e.g. McEachern, 1992; Beedell and Rehman, 1999; Morris and Winter, 2002).

Analysis of compliance leads to an inherent problem of these contractual arrangements. All of the above mentioned institutions are exposed to information asymmetry and therefore, provide examples of incomplete contracts (Brousseau and Farès, 2000). Whereas compliance with cross-compliance is motivated by two parallel enforcement mechanisms, pecuniary incentives for farmers are less clearly identifiable in the case of private food quality standards or QAS. Whether producers receive higher prices after adoption of QAS is less transparent,

¹ Institutions are commonly defined as the written and unwritten ‘rules of the game’ or, in other words, arrangements which structure repeated human interactions (Ostrom and Basurto, 2011).

but certainly they face higher costs. Monetary benefits of additional incentives like improved market access, new access to certain supply chains or higher consumer trust are difficult to quantify. Incentives for moral hazard clearly exist. The economic literature provides various approaches to the analysis of compliant behaviour.² More recently, the economic literature has been influenced by sociological and psychological findings.

Within this paper we review the various approaches to the economic analysis of compliance and apply them to the situation of an agricultural producer. For various reasons individual farmers and managers of enterprises, like cooperatives or processors, might behave differently. Slemrod (2007) highlights the different role of risk aversion and bearing of a possible penalty in both types of organisation. Farmers facing a potential loss of all Single Farm Payments might have to be treated distinctly from a food processor facing the potential loss of one client demanding some food standard certification. However, the overwhelming majority of European farms are run as a family business and some food quality standards, like GlobalGAP or SQF1000, are targeted towards farms and not processors. Finally, a continually increasing range of standards at the retail level reduces the market potential for non-certified produce, increasing the deterrence potential of the loss of certification. Therefore, differences in decision making at farm or firm level will be neglected here, and the analysis will concentrate on one individual decision maker.

Our contribution to the literature is twofold. Firstly, the disparate literature is presented and applied to issues in agricultural production. Thereby, we go beyond the neoclassical theoretical framework mainly used in previous papers (Sutinen and Kuperan, 1999; Hart and Latacz-Lohmann, 2005). Secondly, a discussion of a possible empirical analysis is provided. The remainder of the paper is as follows: Section 2 starts with a model of compliance based on neoclassical utility maximising the theoretical framework. Underlying assumptions are

² See for instance a review of the economic literature on tax compliance by Andreoni et al. (1998) or the literature on corruption reviewed by Jain (2001).

criticised in Section 3 and other motivations of compliance to regulations are presented. Section 4 aims at comparing the different theoretical approaches. An outlook on possible empirical applications concludes the paper.

The standard neoclassical approach

Starting with Becker's (1968) seminal work on the economics of crime, a variety of theoretical attempts to analyse non-complaint behaviour emerged. Applications and further refinements of the Becker model is based on the classical utility maximizing theoretical framework, more specifically, a von Neumann-Morgenstern utility function. The central element of this neoclassical theory is the comparison of an agent's utility in case of compliance in contrast to his/ her utility in the case of non-compliance, the latter being weighted with a probability of detection. The modelling framework described is applied to the case of an agricultural producer in the following discussion.

According to the standard neoclassical model, farmers maximize their profits subject to a production technology constraint. The standard outcome of this optimization problem is a (short-run) system of variable input demand and variable output supply relationships, which are a function of input and output prices, quasi-fixed factors (capital, land, family labour), and dynamic shifters like technological change and genetic progress. If some inputs or outputs are restricted (e.g. the milk quota), than these restricted variables are also included in the set of explanatory variables. The outcome of the optimization reflects the farmers' decisions regarding input and output mix, where increasing costs of production (input price increases) lead generally to a decline in input demand as well as output supply. Increasing output prices, in contrast, show a reverse effect: they lead to an increased output (supply) as well as increasing demand for variable inputs.

Understanding the impact of regulation within the neoclassical economic framework can be obtained in two steps: Firstly, one could include regulation as a further constraint on production possibilities, and therewith as factors affecting the production technology. Secondly, one could allow for the possibility that farmers might violate the regulations or show non-compliant behaviour (Sutinen and Kuperan, 1999).

To begin with the first approach, regulation is treated as further constraint on production possibilities, and therewith as factor affecting the (effective) production technology. Since imposed regulations reduce the production possibility set (excluding possibilities that were allowed without the regulations being imposed) in general they are expected to negatively affect production or to increase the costs of production. Defining output supply vectors as $\mathbf{q}(\cdot)$ and input demand as $\mathbf{x}(\cdot)$, a typical solution to this problem would be

$$\text{Max}\{\mathbf{p}\mathbf{q} - \mathbf{w}\mathbf{x} \mid f(\mathbf{q}, \mathbf{x}, \bar{\mathbf{r}}; t)\} \text{ with } \mathbf{q} = q(\mathbf{p}, \mathbf{w}, \bar{\mathbf{r}}; t) \text{ and } \mathbf{x} = x(\mathbf{p}, \mathbf{w}, \bar{\mathbf{r}}; t) \quad (1)$$

where \mathbf{p} and \mathbf{w} represent a vector of output prices and input prices, and t represents technical change. Regulatory constraints are represented by the vector \mathbf{r} , with the bar indicating that they are assumed to be binding (i.e. restricting a farmer's behaviour).³ All functions are assumed to be 'well-behaved', i.e. output supply as well as input demand increasing in \mathbf{p} and decreasing in \mathbf{w} . Substituting the supply and demand relationships into the profit condition would yield the dual (optimum value) profit function $f(\mathbf{p}, \mathbf{w}, \bar{\mathbf{r}}; t)$ which gives the profits associated with the regulatory regime. As denoted before the profits including the regulatory constraint impact will be lower than without the regulation, i.e. $f(\mathbf{p}, \mathbf{w}, \bar{\mathbf{r}}; t) \leq f(\mathbf{p}, \mathbf{w}; t)$. The drawback of this first approach is that it is implicitly assumed that the regulatory constraints

³ Here we discuss the case of restrictions on input use like manure or stocking density. In the Annex A we provide the opposite example if a certain regulation requires more of one factor, for instance more labour, or one-time investments. The general conclusions remain unaffected.

are fully integrated in the farmer's behaviour. In other words, regulations are fully respected and there will be full compliance to them.

Secondly, the possibility that farmers might violate the regulations or show non-compliant behaviour is allowed for. Rather than respecting the regulation a farmer could choose a level $\mathbf{r}(>\bar{\mathbf{r}})$ rather than the restricted level $\bar{\mathbf{r}}$. For example, the farmer may decide to apply organic manure on grassland at a rate which goes beyond the regulated level of 170 kg N/ ha as specified in the EU's Nitrate Directive (Council Directive 91/676/EEC). In this case the difference $(r_i - \bar{r}_i)$, i.e. the amount of manure application exceeding the imposed standard, is illegal. If the farmer violates the regulation there are in principle two possibilities: The violation will be detected and, subsequently, a punishment follows or the violation is not detected. If detected a penalty fee (g) is imposed on the farm, which will usually be a function of the degree of violation, i.e. $g = g(\mathbf{r} - \bar{\mathbf{r}})$. So if detected

$$g > 0, \text{ if } \mathbf{r} \geq \bar{\mathbf{r}} ; g = 0 \text{ otherwise.}$$

and

$$\frac{\partial g}{\partial r_i} \geq 0, \quad \frac{\partial^2 g}{\partial r_i^2} \geq 0 \quad \forall \mathbf{r} > \bar{\mathbf{r}}$$

where it is implicitly assumed that $g(\cdot)$ is a continuous function and differentiable for all $\mathbf{r} > \bar{\mathbf{r}}$.⁴

Let $f(\mathbf{p}, \mathbf{w}, \mathbf{r}; t)$ be the (dual) profit function as before, where r_i denotes the level of the regulated activity the farmer would choose in the case no restrictions are imposed (i.e. the level corresponding to $f / r_i = 0$, or with a zero impact on marginal profits). More generally the impact of a change in or restriction on r_i on profits could be derived from impacts on

⁴ It seems to be more realistic to assume a piece-wise constant penalty function g . That means, the penalty will remain constant over a certain range of non-compliant behaviour. At certain thresholds the penalty will increase. However, this would render a much more complicated analysis of producer's optimization.

revenues (e.g. yield reduction) and/ or costs (including costs due to adjustment to a more expensive input mix, additional labour input, expenses for paper work and record-keeping activities, licenses, charges, certificates etc.). Since, in principle, variable costs (and consequently also marginal costs and thus supply) are a function of the regulatory constraint, imposing a binding regulation is likely to lead to an upward shift of the cost curve. Given an unchanged product price level output supply will decline. So, as soon as r_i becomes a regulated factor it will affect profits, and a relaxation of the constraint would create a positive impact on marginal profits, i.e. $f/r_i > 0$.

In an imperfect law enforcement system not every violator is detected. Let the probability of detection be given by α .⁵ If detected, a punishment follows and the farmer's profits will be equal to the profits without taking into account the regulatory constraint $f(\mathbf{p}, \mathbf{w}, \mathbf{r}; t)$ less the punishment fee $g(\mathbf{r}-\bar{\mathbf{r}})$, or equal to $f(\mathbf{p}, \mathbf{w}, \mathbf{r}; t) - g(\mathbf{r}-\bar{\mathbf{r}})$. If not detected, the farmer's profits are $\pi(\mathbf{p}, \mathbf{w}; t)$. Assuming the farmer follows an expected utility maximization approach (which for the case utility $U(f) = f$ coincides with expected profit maximization)⁶, and accounting for the probability of detection, the expected utility or profits are

$$f = \alpha [f(\mathbf{p}, \mathbf{w}, \mathbf{r}; t) - g(\mathbf{r} - \bar{\mathbf{r}})] + (1 - \alpha) f(\mathbf{p}, \mathbf{w}, \mathbf{r}; t) \quad (2)$$

Assuming farmers maximize expected utility or profits, the first order condition for the optimal r_i level of a single regulation is

$$\frac{\partial f(\mathbf{p}, \mathbf{w}, \mathbf{r}; t)}{\partial r_i} \geq \alpha \frac{\partial g(\mathbf{r} - \bar{\mathbf{r}})}{\partial r_i} \quad \text{for all } i = 1, \dots, N_r \quad (3)$$

where the inequality is due to the discontinuity allowed for in the punishment function for the case $r_i = \bar{r}_i$. The optimality condition presented in (3) shows that the farmer will evaluate

⁵ Strictly speaking, distinguished distinction has to be made between the true probability and the perceived probability of detection. With respect to the additional criticism on the neo-classical approach, which we will discuss further below, this conceptual difference is treated as of minor importance.

⁶ (Expected) utility maximization is more general than (expected) profit maximization. For example it easily allows for taking into account risk preference.

the marginal profits of violating the regulation against the expected marginal penalty. In general the farmer will choose a level of r_i for which the marginal profits are equal to the expected marginal punishment penalty. Andreoni et al. (1998) show that as long as the expected utility of cheating is positive, everyone is choosing a level of $r_i > \bar{r}_i$ in the case of input use restrictions. Obviously, especially farmers with high compliance costs, i.e. larger marginal profits, have an incentive to cheat. This result is in line with conclusions by Hart and Latacz-Lohmann (2005).

Two possible and politically relevant extensions should be discussed in the following. First, the above framework assumes an unlimited budget of the audit agency and, therefore, a possible probability of audits close to one. Thus, a fixed budget of the audit agency is introduced to make this model more realistic. Assume that the agency receives a budget B which could be expressed as an amount $b=B/N$ per farmer. Consequently, the probability of detection is modelled as function of available expenditures per farm $\mu(b)$. In general, in the case of the cross-compliance regulations only 1 per cent of farmers eligible for direct payments will be inspected, with probably larger samples for specific cases. Additionally, countries might also have their normal regulatory checks and inspections. In case of voluntary certification schemes, participating farms are often inspected more frequently, and may be inspected once a year⁷. Surprisingly, the extension does not alter the general conclusion derived from Equation 3. Only the marginal penalty, the right part of the above inequality, will be shifted upwards. Marginal profits of violating the regulation, the left part of the inequality, will not be affected.

Second, individual farmers might not face the same probability of detection. For instance, dynamic regulator-regulation relationships are neglected up till now. The sample selection for

⁷ Note that even when the whole (participating) population is inspected, this will only verify the behaviour of the participant at the moment of inspection. At other moments in the same year the situation might be different from this moment. For that reason in case of process standards an annual inspection of the whole population would still imply a μ less than 1.

audits often does not proceed randomly. In a more realistic manner previously detected violators will be overrepresented in a sample for auditing. Thus, a farmer once detected will face a higher probability of auditing in the future. Furthermore, the audit agency could run more audits in ecologically sensitive areas. To deal with the first case, the probability of detection is defined as a function of the information set I . This information set is a function of current and past indicators of a farmer's behaviour (or situation) observable to the auditor, such as the location of the farm in sensitive areas or previously failed audits (e.g. risk-based sampling with cross compliance). Furthermore, the probability of detection can be allowed to depend on the number of imposed regulations. Both extensions turn the probability of detection into a function depending on the information set and/or the farm-specific number of regulations $\pi(I, N_r)$. In the latter case it is, for example, implicitly assumed that the number of binding regulations will be higher or the degrees of freedom within the regulation will be stricter in erosion risk-prone areas, wetlands or otherwise ecologically sensitive areas.

Again an extension like $\pi(I)$ or $\pi(N_r)$ does not alter the general conclusion derived from Equation 3. Only the marginal penalty, the right part of the above inequality, will be shifted upwards with an increasing number of regulations. Marginal profits of violating the regulation, the left part of the inequality, will not be affected. However, introducing dynamic repercussions on the farmer's side will also require adjustments on the right-hand side.

Previous empirical research has shown that the (perceived) likelihood of detection, π , exhibits a greater influence on compliant behaviour than the height of the punishment and the likelihood to be punished (Winter and May, 2001).

The value of the penalty might be difficult to determine. Regarding cross-compliance the penalty for non-compliance consists of a partial loss of the Single Farm Payment. Deductions start at 1 per cent of the total SFP (and since 2007 also part of the payments received from the Rural Development Program). In general penalty-reductions are based on the extent, the

severity, the permanence, the repetition and the intentionality of the non-compliance. The total payment will be held back, for instance, in the case of “over-declaration” of land. The European Commission publishes data on control incidence, farmers’ compliance and applied reductions for 2005 (EC, 2007). Non-compliance with resulting reductions of SFP were reported for 12 % of controlled farmers. But 68% of the reductions were applied at the minimum level of 1% of direct payments (EC, 2007; p. 4). According to the European Court of Auditors (ECA, 2008), in 2005 the deduction was about €10 million (out of a total direct aid amounting €40 billion). Most recently, a new minimal fine threshold to execute the fine is established at a level of 100 €(Agra Focus, 2008 (no. 144); p. 8).

In the case of private food quality standards, e.g. for a GlobalGAP certified farm, non-compliance with a minor requirement might result in a fine but could lead to the loss of the certificate if major requirements are violated. For instance, the protocols of GlobalGAP recognize three levels of compliance criteria: ‘major must’, ‘minor must’, and ‘recommended’. For the ‘major must’ criteria a hundred per cent compliance of all applicable major must control points is compulsory. For the ‘minor must’ criteria a ninety per cent compliance of all the applicable minor must control points is compulsory. For the ‘recommendations’ no minimum percentage of compliance is set. Within GlobalGAP three types of sanctions exists: warning (allows some time for correction), suspension (GlobalGAP logo suspended for some time) and cancellation (cancellation of contract and prohibition to use license or certificate). If non-compliance is detected with respect to a ‘major must’, then immediate complete certificate suspension follows (for a minimum of 6 month). If repetition occurs in subsequent audits, then the certificate is cancelled. If a farmer or a group of farmers notify non-compliance with a ‘major must’ in advance, before externally detected by a certification body, and put in place suitable corrective actions, then immediate partial suspension of the certificate is imposed. If more than 10% of the applicable minor musts are

not complied with, then a deferred suspension of the certificate is imposed. However, data on sanctions and penalties executed within those schemes are hardly at all available.

Weakening of neo-classical assumptions

As indicated above, out of the detected violations of cross-compliance requirements about 70% of the fines were below 50 Euro. Additionally, the estimated average probability of on-the-spot checks for cross-compliance ($p = 0.05$) is very low. Even if audit sampling is risk based and proceeds non-randomly, farmers may normally not expect an audit every year. Thus, the deterrence effect is quite small, and according to the expected utility framework a high rate of non-compliance would be predicted. Observed best-estimate compliance rates, however, often indicate a relatively high level of compliance. Either farmers operate at very low marginal profit levels with respect to the total number of regulations, i.e. near their profit maximum, or there are additional reasons for compliant behaviour.

Such anomalous behaviour--people comply at a significant higher rate than expected according to what utility theory predicts-- has been found in various circumstances like tax evasion (Alm et al., 1992) or low probability-high loss events in general (Machina, 1987). The observation that people behave more honest than theory predicts, mainly in experiments, or even completely altruistically, has inspired a wide literature. For instance, Alm et al. (1992) obtain a substantial compliance rate in tax payer experiments even without any chance of detection. More formally, the observation that people are thought to behave compliantly a large part of their time--despite a quite low frequency of surveillance and rarely receiving fines even in the case of detected violations--is known as the "Harrington paradox" (OECD, 2004).

The following discussion will provide possible evidence of additional motivations to comply. We will concentrate first on criticism within the above described economic

framework. Research over the last two decades has shown that people do not only care about economic incentives but also about the well-being of other humans; they also exhibit social preferences (Fehr and Falk, 2002). Therefore, drivers of human behaviour are discussed from a psychological perspective followed by determinants derived from the sociological literature. We use a very simple rule to discriminate between both strands: all factors that relate directly to an individual's attitude are classified as psychological, and the determinants which shape honesty indirectly via the society around the agent are termed as sociological. Our final concern is the link between institutional quality and compliance.

Criticisms of assumptions of expected utility theory

The following three axioms of agent's preferences related to certain prospects are underlying the expected utility theorem, more specifically the existence of a von Neumann-Morgenstern utility function: ordering, requiring itself completeness and transitivity; continuity; and independence. Whereas the first two axioms--ordering and continuity--are common for every economic model of choice, the independence axiom implies that any prospect that is weakly preferred to another will also be weakly preferred if weighted with the same probabilities (Starmer, 2000). Additionally, it is assumed within the expected utility framework that the agent knows all possible outcomes and related probabilities of his or her choices. Kahneman and Tversky (1979), Tversky and Kahneman (1986), Machina (1987) and Rabin and Thaler (2001), to name only some examples, provide an ample discussion of those axioms. In particular, experiments show that respondents show no consistent behaviour if faced with non-weighted and weighted prospects. Therefore, most alternatives of the expected utility theory relax the independence axiom. For an extensive review of the literature the interested reader is referred to Schoemaker (1982) and Starmer (2000). In the following, some selected critics which seem to be most relevant for our examples are discussed more extensively, but

an exhaustive survey of the literature would go beyond the scope of this paper. More specifically, we will discuss the relevance of losses and gains versus changes in wealth levels, the framing effect and problems of deriving objective probabilities of detection.

One of the most prominent alternative developments of the expected utility theory is the *prospect theory* introduced by Kahneman and Tversky (1979). Their work is based on results from various simple choice experiments at three different universities and includes a procedural aspect, assuming that an agent's decision follows some heuristics or rules (Starmer, 2000). One central element of prospect theory is the notion that arguments of the utility function are rather changes in wealth than the final asset position. Thus, in a first stage, respondents order the different prospects they face with respect to gains and losses related to a subjectively chosen reference point. They do not integrate previous entitlements and potential gains to determine a maximised outcome as a first choice. In a second stage, potential outcomes and related probabilities are evaluated and the alternative with the highest utility selected. Consequently, the first phase of decision in prospect theory violates the transitivity axiom of the expected utility theory. Kahneman and Tversky (1979) show that their proposed approach is capable to explain risk-averse behaviour in the case of potential gains but risk-seeking behaviour in the case of potential losses. In a later paper they use the terms 'diminishing sensitivity' to explain the convex and concave shape of their value function, and 'loss aversion' to describe the steeper curve in the domain of losses compared to the domain of gains (Tversky and Kahneman, 1992).⁸ Many authors usually assume the reference point equivalent to a status-quo wealth position. Therefore, it follows from the prospect theory that each farmer will evaluate a certain fixed penalty differently. Implementation of cross-compliance regulation takes account of this in assuming fines as a percentage of the farm specific Single Farm Payment.

⁸ Additional elements of the prospect theory like the certainty and the reflection effect seem to be of more theoretical relevance and will not be discussed here. See Kahneman and Tversky (1979) for a detailed description.

A formal exposition of the prospect theory to the question of compliance is developed below based on the work by Tversky and Kahneman (1992).⁹ The major change with respect to the deterrence model above is the distinction between the profit if a violation is detected and if not.

$$f(p, w, \bar{r}; t) = \begin{cases} f^+ & \text{if } \pi = 0 \\ f^- & \text{if } \pi = 1 \end{cases}$$

A value function is specified depending on the changes in utility, where in turn utility is a function of the change in profits, or $u(\cdot)$. As outlined above, the choice of a reference point is crucial.¹⁰ Under the assumption of compliant behaviour as the reference, the two possible outcomes are $\Delta f^+ = f(\mathbf{r})$ in the case of non-detection of deviation and $\Delta f^- = f(\mathbf{r}) - g(\mathbf{r} - \bar{\mathbf{r}})$ if a violation is detected and punished. It is assumed that the value function is concave for gains and convex for losses. The third prospect, no change in income, is valued zero and, therefore, drops out. A second important element of prospect theory is the underestimation of high probability events and overestimation of low probability events. To take this discrepancy between the perceived and actual probability of detection into account, the probability of detection is replaced by a weighting function $\pi(\cdot)$, a necessary nonlinear transformation of the probability scale (Tversky and Kahneman, 1992). Following Al-Nowaihi et al., (2008), and if preference homogeneity holds, the value function could be written as a power function with equal exponents for gains and losses. Subsequently, the farmer's new objective function becomes:

$$V = \{^+(1 - \pi)u(f^+(\mathbf{r})) - \} \{^-(\pi)u(f^-(\mathbf{r}))\} \quad (4)$$

The variable β is called the coefficient of loss aversion, implying that $\beta > 1$. Maximizing V with respect to r_i yields the following optimal solution (see Annex B for further details):

⁹ Yaniv (1999) as well as Dhami and al-Nowaihi (2007) provide a similar exposition in the case of tax evasion.

¹⁰ Most recent developments allow to model an uncertain point of reference (Schmidt et al., 2008). However, as the focus of this paper is to compare the theoretical approaches, a simplification is opted for.

$$\frac{\partial f}{\partial r_i} \geq \left(\frac{-\{\}^{-}(\pi) \frac{\partial u(f^{-})}{\partial f^{-}}}{\left[\{\}^{+}(1-\pi) \frac{\partial u(f^{+})}{\partial f^{+}} - \{\}^{-}(\pi) \frac{\partial u(f^{-})}{\partial f^{-}} \right]} \right) \frac{\partial g(\mathbf{r})}{\partial r_i} \quad \text{for all } i = 1, \dots, N_r \quad (5)$$

As (5) shows, marginal profits are related to marginal penalty, just like in equation (3), but now a ‘correction’ factor (see first right hand side term in brackets) is added. This term depends on $\partial u(f^{+})/\partial f^{+}$ and $\partial u(f^{-})/\partial f^{-}$ which together capture the degree of loss aversion. Moreover, it depends on the weighting function reflecting the difference between the objective and perceived probabilities on detection and non-detection. As can be easily checked, if there would be no loss aversion, i.e. $\partial u(f^{+})/\partial f^{+} = \partial u(f^{-})/\partial f^{-}$, and the perceived and objective probabilities would coincide, i.e. $\{\}^{+}(1-\pi) = (1-\pi)$ and $\{\}^{-}(\pi) = \pi$, then (5) would be exactly equivalent with (3).

Nowadays the violation of the independence axiom within the expected utility framework is better known as *framing effect* (Tversky and Kahneman, 1986). Preferences over prospects are not independent on how they are presented. Starmer (2000) describes this phenomenon as violation of the description invariance underlying conventional theory. In order to give an example, consider two alternative descriptions of the same situation: Case A: A farmer’s violation of a regulation will be punished with a 1% of the SFP given a probability of 10 per cent of detection (inducing an expected loss of 0.1% in payments). Case B: Having violated a regulation and being detected, a farmer is only eligible to 99.9% of the full SFP¹¹. A framing effect would exist if a farmer would behave differently facing one of the two descriptions. Similarly, people might react differently on the probability of a penalty and the potential benefit of a higher price. The example of framing in tax law by Schelling discussed in Tversky and Kahneman (1986) has also a high relevance for the case of cross-compliance and their acceptance among the general public. Obviously, payments if expressed as a reward for

¹¹ Note that the expected value of the payments received for both cases is the same!

complying with the law will be judged much more sceptically by the non-farmer audience than payments in exchange for farmers' efforts to reduce negative environmental effects of production activity.

Finally, people may fail to estimate and revise subjective probabilities for themselves, resulting in systematic mistakes. Alm et al. (1992) show that people appear to overestimate the probability of an audit. Similarly, it has been shown that agents subjectively overestimate the expected penalty, as well (OECD, 2004).

As pointed out by Starmer (2000), non-conventional approaches of utility theories, incorporating evidence from psychology and sociology, are not able to define one single utility function. Instead of defining one utility function over individual prospects, non-conventional theories assume that individuals base their choices on decision rules or choices. Therefore, we are not able to continue the formal presentation of a farmer's compliance decision as presented above within the next paragraphs.¹²

Psychological literature

Part of the reason for a farmer's compliance that is unexplained by the above utility maximisation framework might be influenced by external and internal factors. Whereas economic theory focuses almost exclusively on external rewards of human behaviour, psychology is mainly concerned with the internal motivation of certain behaviour. Intrinsic motives are qualified through the absence of any apparent incentive (Frey and Jegen, 2001), or "superego" in the terminology of Mazar and Ariely (2006). In this context, Sutinen and Kuperan (1999) distinguish between two groups of thoughts.

¹² In this respect we deviate from the approaches developed by Sutinen and Kuperan (1999) as well as Sandmo (2006). The authors include a variable of an individual's moral standing as a function of the similarity between regulation and individual's values into their objective function. However, their solutions are still based on the expected utility framework.

The first, so-called instrumental perspective, assumes individuals as driven purely by self-interest. They respond only to changes in the tangible, immediate incentives and penalties associated with non-compliance. Frey and Jegen (2001) summarise sources that explain the possible disincentive effect of external intervention in intrinsic motivation. This effect is known as cognitive evaluation theory in the psychological literature. A beneficial personal motivation, e.g. a positive attitude towards active environmental protection, might be corrupted through the introduction of explicit monetary rewards. Frey and Jegen (2001) term it as a crowding-out effect and present empirical relevance from several economic studies.

The second perspective, called normative, emphasizes what individuals consider just and moral, instead of what is in their self-interest. Individuals tend to comply with the law to the extent that they perceive the law as appropriate and consistent with their internalized norms. The key variables determining compliance in the normative perspective are individuals' perceptions of the fairness and appropriateness of the law and its institutions (Sutinen and Kuperan, 1999). Within this normative perspective, the cognitive theory explains the impact of personal motivation and the level of personal development on an individual's behaviour. People show pro-social behaviour (Alm et al., 1992).

Finally, psychological research has shown that people might behave completely differently in situations of emotional engagement than in situations without being emotionally aroused ("heat of the moment") (Amir et al., 2005). Put differently, despite the cognitive awareness about how to treat animals or how to apply chemicals correctly, farmers can violate codes of practice in stressful situations or under similar circumstances. Contrary to the factors discussed above, this behaviour might increase non-compliance.

Task complexity, an additional argument raised by Carroll (1978), implies that agents are behaving with a 'limited' rationality at best. This could be especially relevant in the case of cross-compliance with 19 requirements. However, such a concept works better to explain

non-compliance instead of a higher compliance than predicted by the expected utility theory.¹³

Sociological literature

Following Fehr and Fischbacher (2002), the theory of (positive) reciprocity represents quantitatively the most important type of social preferences. The theory implies that people respond positively to some friendly actions without expecting further benefit from their doing so. Fehr and Gächter (2000) distinguish between reciprocity and cooperation as the latter requiring a future interaction of the involved agents and, subsequently, a positive expected value from today's friendly response. Applying the expected utility theory, agents would expect to show no friendly behaviour if no further interactions are foreseen. Human behaviour develops over time, probably to a larger extent during adolescence, and is shaped by parents, peer groups or stigmas. Stigma might result as a reaction of the surrounding people to revealed non-compliant behaviour (Deffains and Fluet, 2007). However, different peer groups could have quite opposing influences depending on the involvement. For instance, a farmers' association might have a negative attitude towards a stricter environmental regulation, whereas the surrounding non-farming village community might appreciate it. Similarly, social norms or society's expectations with respect to animal welfare conditions, soil conservation, water use, application of chemicals or biodiversity differ in many instances from beliefs of a farming peer group.

Reference to reciprocity might help to solve this discrepancy. However, reciprocity needs a positive incentive. For instance, Bardsley and Sausgruber (2005) find that a reciprocally motivated agent will contribute to a public good only if he or she receives a benefit from it. The non-binding chosen level of worker's effort, as another example, is shown to be

¹³ Garoupa (2003) provides a critical review of behavioural approaches to the law and crime literature. However, his conclusion about the potential contribution of behavioural economics to this literature is rather sceptical.

positively related to the principal's wage offer (Fehr and Fischbacher, 2002). Within the literature about reciprocity, several authors describe the orientation of own behaviour with regard to certain reference groups with the terms 'conditional cooperation', 'conformity' or the 'desire of social approval' (Pretty and Ward, 2001; Fehr and Falk, 2002; Henrich, 2004). Results from various experiments support these concepts. Thus, an individual farmer is expected to be more willing to comply with a regulation if many farmers respect it (Fehr and Falk, 2002) or, similarly, a farmer has a motivation to fulfil social norms or expectations of the farmer's peer group (Henrich, 2004). Bohnet and Zeckhauser (2004) and Bardsley and Sausgruber (2005) describe conformity as an incentive to adjust own behaviour according to "social comparisons" even without material consequences.¹⁴ Bohnet and Zeckhauser (2004) show that people in ultimatum game experiments do not react to information about randomly chosen offers but revise their action if faced with average offers. That is, information about a certain type of consensus within a group or society acts as an incentive to adjust own behaviour. Generally, it is expected that above mentioned factors will be more influential in cooperative cultures with strong communal norms (OECD, 2004).

The influence of a society on an individual's behaviour is a central element of the field experiments by Henrich et al. (2001). The authors find in 15 small-scale societies involved in agricultural production clear evidence of group-level economic organisation and market integration as a driver of individual behaviour instead of self-interest. More specifically, two dimensions of societal interaction, payoffs to cooperation and market integration, explain the variation in the results of the field experiments to a large extent. Moreover, none of the individual level explanatory variables added a significant contribution to an actor's behaviour in the games. Henrich et al. (2001) conclude from their results that the economic conditions and social interactions of everyday life shape an individual's preferences, and that these are

¹⁴ Bardsley and Sausgruber (2005) highlight explicitly the difference between the economic concept of conformity and that here applied in calling it "normative conformity".

not exogenous. Turning to empirical support of the theory of reciprocity from cross-country analysis, Frey and Torgler (2007) present several illustrative examples using data from the European Value Survey (EVS). Their econometric results point to a significant relation between the degree of tax evasion in a country perceived by respondents and the respondent's own readiness to evade taxes.

One illustrative example of social motives to comply with regulations requiring a greater quality or higher level of response is the case of the Canadian Best Management Practice (BMPs) programs, which have a similar aim as the EU's Good Agricultural and Economic Conditions (GAEC) standards. Agriculture and Agri-Food Canada (AAFC) (2006) defines Beneficial Management Practices (BMPs) as "farm management practices that: minimize and mitigate impacts and risks to the environment, by maintaining or improving the quality of soil, water, air and biodiversity; ensure the long term health and sustainability of natural resources used for agricultural production; and, support the long-term economic and environmental viability of the agriculture industry." As part of the program, farmers attend an Environmental Farm Plan workshop and complete a workbook designed to assess the current state of the farm and identify areas of concern. Then farmers develop an action plan for addressing the areas of concern. The action plan is confidentially reviewed by a group of locally appointed farmers. Once the Peer Review Committee approves the Action Plan, a farmer can participate in the EFP Cost-Share Program that helps cover a portion of the costs of implementing eligible projects from the action plan.

Producers are eligible to apply for cost-share incentives through the Canada Farm Stewardship Program, Greencover Canada, and the Canada Water Supply Expansion Program. The federal government covers up to 60% of the cost of implementing eligible practices. Many practices covered through federal cost share programs are also eligible for funding under different provincial cost share programs. As a result up to 90% of the total

project cost can be covered by combining federal and provincial funds. However, the coverage varies depending on farmer eligibility, provinces and type of Best Management Practices. Despite the fact that the implementation of Best Management Practices is not mandatory, there has been a relatively high degree of participation. For example, between 2005 and 2007, more than 11,000 of 57,211 Ontario farmers implemented or were in the process of implementation of BMPs. Even though the implementation of Beneficial Management Practices is partly subsidized by the federal and provincial governments, it is not costless to the farmers. As an example, Ontario farmers bore about a third of the cost of implementation of the management practices eligible for funding. Net costs for participating farmers could amount to about €1000 per farm. The reason farmers are prepared to pay these costs is that they recognize the environmental problems and the societal demands to behave as good citizens that each contribute their 'fair share' (Fox and Rajsic, 2007).

The study by Burton et al. (2008), which analyses the non-economic determinants of adoption of voluntary agri-environmental programmes, provides another empirical illustration of society's influence on a farmer's behaviour. The authors highlight the expression of cultural capital, that is to demonstrate oneself to be a 'good farmer' as an important motive for a farmer. Following the line of this argument implies to expect a higher degree of compliance if the result of such a behaviour is more visible to the farming community around the farm.

Institutional quality and compliance

Tyran and Feld, (2006) summarise the discussion about mild (without deterrent sanctions) and severe law (with deterrent sanctions). The above mentioned mechanism of conditional cooperation or the own commitment act as motivation for compliant behaviour in the case of endogenously enacted laws. This type of regulation applies more to quality standards than to

cross-compliance. Following the results from experiments by Tyran and Feld (2006), a significantly higher compliance to endogenously introduced ‘laws’ like voluntary standards should be expected than to exogenously enacted mild laws like cross-compliance. Thus, farmers are expected to be more willing to obey voluntary standards or contractual arrangements compared to exogenously imposed regulations.

Following Slemrod (2007), an agent’s behaviour depends on the behaviour of the regulating body (labelling organisation, cross-compliance implementing organisation). The author terms this interaction as reciprocal altruism. Closely related is Levi’s (1998) concept of a “contingent consenter”: if government is judged as expressing people’s interest, people cooperate by paying taxes even if free-riding will give higher utility in the short-term interest. Empirical studies underline the influence of the way how regulations are developed, implemented and enforced on the personal motivation to comply with rules and laws. For instance, empirical evidence of higher tax compliance in environments with better institutional quality is given by Frey and Torgler (2007). There is a significant difference in tax morale between Western and Eastern Europe that authors relate to the disruption in the institutional framework. Finally, Frey and Torgler (2007) find a significant lower readiness to cheat on taxes if people have a higher satisfaction with the state of democracy in their country and if they are living in countries with a better institutional quality.¹⁵ All these outcomes of perceptions of fair treatment on individual behaviour is summarized by Frey et al. (2004) under the heading of ‘procedural utility’.

Regarding EU agricultural policy, the link between institutional quality and the implementation of EU regulations is nicely illustrated by the different experiences of Member States with the implementation of the dairy quota at the beginning of the 1980s. Some

¹⁵ Six proxies of institutional quality provided by Kaufmann et al. (1999) covering perceived levels of accountability of political processes, political stability, government effectiveness, regulatory quality, rule of law and control of corruption are used.

Member States, especially Spain and Italy, introduced the necessary regulation very late or did not properly enforce existing legislation (Williams, 1997). Similarly, Buller (2000) describes the varying speed of implementing the EU Regulation 2078/92 on agri-environmental schemes across EU Member States. Among the first countries to establish national agri-environmental programmes were France, Germany, the Netherlands, Spain, and the UK (Buller, 2000, p. 228).

Which picture could be drawn in real-world situation?

For an illustration of the extent of compliance among EU farmers see Table 1, which summarizes best estimated degrees of compliance for a selected set of SMRs and GAECs. Because of the uncertainties and problems with exact measurement, general classifications are made rather than reporting specific numbers. The general impression from Table 1 is that compliance is rather high for measures such as groundwater protection and sewage sludge requirements. With respect to the Nitrate Directive and the identification and registration of bovine, ovine and caprine animals, compliance rates are significantly below the level of full-compliance.

Table 1 around here

The Table suggests that Member States and conditions are heterogeneous and, accordingly, people behave differently. One outcome of the CAP Health Check of 2008 was to simplify cross-compliance regulation. For instance, the introduction of a *de minimis* concept--first-time offenders will not be punished if the reduction of SFP would be below 100 Euro--helps to deal with unintended offenses. Furthermore, standards without any direct link to a farmer's responsibility have been withdrawn from the cross-compliance catalogue, e.g.

non-farming related articles related to the ‘Conservation of Birds’ and ‘Conservation of Natural Habitats’ directives have been deleted from the SMR catalogue.¹⁶ Finally, the definition of selected criteria has been improved, e.g. a better identification of protectable landscape elements (EC, 2009). In the framework of the determinants of compliant behaviour discussed above, simplification and streamlining of regulations might enhance acceptance by farmers and, thus, provide sufficient incentives to comply.

Comparison of different outcomes and outlook for empirical research

Table 2 presents an overview of the most relevant determinants of compliance. The table has to be read in such a way that every new line from the top to the bottom adds additional determinants rather than coming up with a consistent set of competing determinants. All theories, especially the deterrence model and institutional literature, provide tools to explain the emergence of multiple equilibria (Andvig and Moene, 1990; Tyran and Feld, 2006). Thus, different countries can exhibit persistently different levels of compliance.

Table 2 around here

What lessons can be learned from the approaches discussed above for empirical research on compliance behaviour? First, the neo-classical theory of compliance emphasises the benefit-cost calculation behind compliance behaviour. Whereas the limitations of this framework have been discussed above, it is relevant to include such variables in a model explaining regulatory compliance. What the neo-classical economic approach makes clear is that it is not sufficient to focus on the costs associated with non-compliance only (punishment

¹⁶ More specifically, components of the SMRs 1 (conservation of wild birds) and 5 (conservation of natural habitats) which relate to hunting are no longer linked with cross-compliance but will be still mandatory requirements under domestic legislation.

and probability of violation detection), but that the opportunity costs of compliance (e.g. forgone profits associated with non-compliance) also have to be properly accounted for. Second, the previous exposition makes clear that variables that are traditionally considered to be non-economic also have to be considered. Not doing this would lead to a misspecification in the explanatory model, which is known to lead to biased parameter (or impact) estimates. As regards the factors that have to be taken into account, it was argued that the contributions from the psychological and sociological literature should be accounted for, where the first emphasize the need to consider attitudinal factors or personal motivations and the second point to the role of civic duty, social reciprocity and peer pressure. Also cultural factors were found to play a role, which emphasizes the need for cross-country studies and to be careful about drawing generalisations based on specific case-studies.

Unfortunately, empirical analyses in general lack the possibility to distinguish between wilful and unintended non-compliance. The foregoing theoretical reflections implicitly assume a rational and deliberate behaviour. In real life, a certain share of tax underreporting or even overreporting is caused by non-awareness or misunderstandings of tax laws (Slemrod, 2007). Also, in the case of cross-compliance and food quality standards, non-intended non-compliance cannot be excluded completely. Moreover, Fehr and Fischbacher (2002) present estimates from various experiments that 40 to 60 per cent of respondents behave selfishly. Thus, the expected utility theory might explain the behaviour of roughly one-half of the population. The remaining 50 per cent of the population behave according to the theory of reciprocity. Very recently, Harrison and Rutström (2009) suggest an empirical framework, a mixed model, which is able to represent heterogeneous theories across individuals.

The traditional economic variables are at least conceptually rather clear and associated with a clear (although limited) behavioural framework, and their operationalization is relatively straightforward. The costs of non-compliance follow from multiplying the penalty

associated with violating a standard with the probability of detection, which gives the expected costs of non-compliance. The benefits of non-compliance (equal to the forgone benefits of compliance) can be obtained by evaluating the shadow price of the regulation (following from differentiating the profit function with respect to the regulatory constraint variable). As regards the ‘non-economic’ variables, the operationalization is less straightforward. Based on the theories considered here there is no clear protocol as to which variables have to be included in the analysis. Rather, some general notions are introduced, which have to be measured in an indirect way, most-likely by means of a set of proxy variables. This creates challenges for empirical research, as not only a set of variables has to be selected but also many measurement issues have to be solved. The measurement issue here not only refers to finding a proper scale (for example developing Likert scaled survey questions), but also avoiding measurement biases. In many cases the measurement of these type of variables has to rely on self-reporting, which is known to be subject to biases like giving ‘correct’ or socially acceptable answers, revealing of selective information, etc.

In the following discussion some first illustrations are given of typical examples of indicator variables to be included in models aiming at explaining compliance. Subsequently, some remarks are made about prioritisation, taking into account findings from empirical literature. Typically survey questions are used to measure the internal motivation (impact of psychological factors), aiming at determining the attitude of the regulated entities with respect to the regulation considered. Typical examples are questions focusing on the rating the (perceived) potential harm as a factor to comply, questions on ‘acceptance’ (or perceived legitimacy) of the regulation, and questions aimed at tracing the moral convictions (you should obey the law under all or under specific conditions, etc.). The measurement of social factors is different from the internal factors in that it focuses on social phenomena, but the measurement approaches are rather similar. Also, in the latter case, one is interested to

determine to what extent regulated entities are responsive to social factors. The only way to measure this is, again, by singling out the attitudes of the regulated to these factors. Typical examples of questions aimed at assessing the role of social or environmental factors are (a) the extent to which one believes that others are doing their part, (b) reputation as a compliance-motivating factor, or (c) perceived conformity to the standard of generally accepted good practice codes.

As is clear from the previous discussion, this kind of empirical research will be quite data demanding. As data are often not available and data generation is costly, the question arises whether some priorities can be formulated. In general this is difficult to say. Based on several empirical studies our impression is that impacts of deterrence (in particular specific deterrence aimed at individuals) are observed, but are rare in the practical reality. Monitoring and inspection are costly and often limited in such a way as to undermine effective specific deterrent. This emphasizes the need to go beyond the neo-classical economic model in which deterrence plays such a prominent role. For example, for Danish dairy farmers it was found that about 80 per cent of the farmers experienced a ‘strong sense of civic duty to comply’ and ‘believe others are doing their part’ as important and significant motivations to comply. These outweighed the fear of deterrence (May, 2005). However, differences in regulatory contexts preclude simple generalizations.

Concluding remarks

This paper started by emphasizing the increasing importance of regulations, which might have either a public or a private origin, with respect to agriculture and the production of food. It emphasized the need for a better understanding of compliance with regulations. This is not only a scientific interest, but in particular public regulations nowadays often require so-called regulatory impact assessments (RIAs) as part of their introduction, and there are regulatory

reforms aimed at simplification and improving effectiveness, consistency, accountability and transparency of public administration (e.g. the Commission's White Paper on Governance (EC, 2001, pp. 18-20); all this is part of the better regulation movement (EC, 2005). One element of such assessments is always the analysis of compliance, although until now such types of analysis tend to be done badly. This paper contributes to a better understanding of compliance by exploring and comparatively analysing the different approaches to explain compliance that are found in the social sciences literature. It was argued that the classical economic approach, which interprets compliance as a decision based on a cost – (forgone) benefit-decision, is too limited for a full understanding of compliance behaviour. Moreover, the limits of the expected utility framework underlying this theory were briefly reviewed and contrasted with results from the prospect theory. It was further argued that alongside this utility framework the contributions from the psychological and sociological literature should also be acknowledged. This adds factors such as intrinsic motivations, moral convictions (e.g. obeying laws, stick to one's given word), social preferences, reciprocity and impacts of peer groups. Moreover, it was argued that institutional quality matters as a factor to understand compliance. The general conclusion does not underline the rather pessimistic statement by Tversky and Kahneman (1992) cited above. We conclude that a theory of choice cannot consist of only one single approach.

Whereas one coherent model integrating all these aspects is lacking, at least at this moment, we think that a first priority is to undertake more empirical analyses. These analyses should have a broader focus than deterrence issues. Some suggestions for this are given, although it is recognized that this kind of research will be quite data demanding. However, going along this route should in the end contribute to a better selection of appropriate variables relevant to analyse compliance issues. A better understanding of compliance behaviour is also a crucial element to not necessarily more but better regulation.

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Table 1: Best estimates of degrees of compliance for selected regulations and EU member states ^{*)}

	France	Germany	Italy	Netherlands	United Kingdom	Spain
Environment						
Bird and Habitat Directives	n.a.; probably very high	management plans not yet in place in most areas	management plans not yet in place in most areas	very high	very high	very high
Protection of groundwater	not very high for exhaustible oils	very high	very high	high	very high	very high
Sewage Sludge Directive	very high	very high	very high	very high	very high	very high
Nitrate Directive	dairy farmers low and beef farmers extremely low	not high	extremely low; national implementation tool place only recently	low, (mainly due to recent change in the regulations)	very high	high
Identification and registration						
Identification and Registration of bovine animals	high, but not always within 7 days	very low	n.a.; databank working since 2005	very high	low	very high
Identification and Registration of ovine and caprine animals	extremely low; new regulation since 2005	very low	n.a.; databank working since 2005	high	very high	very high
Public, Animal and Plant Health						
Food Traceability and Food Safety	n.a.	n.a.	n.a.	high	n.a.	n.a.

Notification of diseases	high, no precise estimate available	n.a.	n.a.	high	n.a.; since 1 January 2006 imposed	n.a.
Animal welfare	expected to be high	expected to be high	expected to be high	expected to be high	expected to be high	n.a.
Good Agricultural and Environmental Condition	n.a.	very high	n.a.	not high	very high	very high

Source: (Jongeneel et al., 2007)), p. 57.

^{*)} Because of uncertainties and measurement problems only general characterizations are given. The following legend was used: Compliance is considered ‘very high’ if the degree of compliance is greater than 95% (95% of the farmers or more are fully compliant). Compliance is labelled as ‘high’ in case the degree of compliance is in the interval 90%-95%. Compliance is labelled as ‘not high’ if compliance rates were in interval 80%-90%. Compliance was labelled ‘low’ when the degree of compliance was in the interval 70%-80%. It was labelled as ‘very low’ when the degree of compliance was in the interval 40%-70%. Finally, it was labelled to be ‘extremely low’ in case of compliance rates below 40%. n.a. – not available.

Table 2: Determinants of compliant behaviour according to different strands of the literature

Theory/ Literature strand	Determinants		
Expected utility theory	Chance of getting caught/ penalised	Size of penalty	Individual's degree of risk aversion
Prospect theory	Gains and losses with respect to reference point	Diminishing sensitivity	Loss aversion
Psychological literature	Internalised attitudes "superego"/ personal moral beliefs	Pro-social behaviour	
Sociological literature	Reciprocity with principal's action	Conformity with peer group	
Institutions	Trust in institutions in general	Satisfaction with institutional framework – "against all"	

Source: Own presentation

Annex A: Case of higher input requirements and non-continuous requirements

Assuming a regulation which requires a farmer to use more labour than would be supplied otherwise, denoted \underline{r}

$$\text{Max}\{\mathbf{p}\mathbf{q} - \mathbf{w}\mathbf{x} \mid f(\mathbf{q}, \mathbf{x}, \underline{r}; t)\} \text{ with } \mathbf{q} = q(\mathbf{p}, \mathbf{w}, \underline{r}; t) \text{ and } \mathbf{x} = x(\mathbf{p}, \mathbf{w}, \underline{r}; t) \quad (\text{A-1})$$

Examples from the cross-compliance catalogue are animal registration, especially double ear tags for bovine, ovine and caprine animals, and all documentation tasks.

It still holds that $f(\mathbf{p}, \mathbf{w}, \underline{r}; t) \leq f(\mathbf{p}, \mathbf{w}; t)$.

If the farmer violates the regulation and will be detected subsequently, a penalty g might be imposed. In contrast to the previous, the penalty is not a direct function of the degree of violation. So if detected

$$g(r) \begin{cases} > 0 & \text{if } r < \underline{r} \\ 0 & \text{otherwise} \end{cases}$$

and

$$\frac{\partial g}{\partial r} \geq 0, \quad \frac{\partial^2 g}{\partial r^2} \geq 0 \quad \forall r > \bar{r}$$

where it is implicitly assumed that $g(\cdot)$ is a continuous function and differentiable for all $r > \bar{r}$.

The decision under expected utility theory becomes:

$$f = \pi [f(\mathbf{p}, \mathbf{w}, r; t) - g(r)] + (1 - \pi) f(\mathbf{p}, \mathbf{w}, r; t) \quad (\text{A-2})$$

Subsequently, the first order condition for the optimal r level is

$$\frac{\partial f(\mathbf{p}, \mathbf{w}, r; t)}{\partial r} \geq \pi \frac{\partial g(r)}{\partial r} \quad (\text{A-3})$$

where the inequality is due to the discontinuity allowed for in the punishment function for the case $r = \underline{r}$.

Annex B: Solving the optimization problem for prospect theory-model

The value function (4) associated with the prospect theory approach is

$$V = \{^+(1-\alpha)u(f^+(r)) - \}\{^-(\alpha)u(f^-(r))\} \quad (\text{B-1})$$

The optimum level of compliance is found by differentiating (B-1) with respect to the constraining standard r_i . This yields the first order condition which should be equal to zero for an optimum.

$$\frac{\partial V}{\partial r_i} = \{^+(1-\alpha)\frac{\partial u(f^+)}{\partial f^+}\frac{\partial f^+(\mathbf{r})}{\partial r_i} - \}\{^-(\alpha)\frac{\partial u(f^-)}{\partial f^-}\frac{\partial f^-(\mathbf{r})}{\partial r_i} = 0 \quad (\text{B-2})$$

It should be noted that $\frac{\partial u(f^+)}{\partial f^+}$ and $\frac{\partial u(f^-)}{\partial f^-}$ might be quite different, for example because the risk aversion for gains and losses differs. Note that $u(f^-) = u(f(\mathbf{r}) - g(r_i - \bar{r}_i))$, a specification which assumes “perfect asset integration” between profit and direct payment income. (B-2) may then be rewritten as

$$\frac{\partial V}{\partial r_i} = \{^+(1-\alpha)\frac{\partial u(f^+)}{\partial f^+}\frac{\partial f^+(\mathbf{r})}{\partial r_i} - \}\{^-(\alpha)\frac{\partial u(f^-)}{\partial f^-}\left(\frac{\partial f(\mathbf{r})}{\partial r_i} - \frac{\partial g(r)}{\partial r_i}\right) = 0 \quad (\text{B-3})$$

Subsequently solving (B-3) for marginal profits $\partial f / \partial r_i$ yields

$$\frac{\partial f}{\partial r_i} \geq \left(\frac{-\{^-(\alpha)\frac{\partial u(f^-)}{\partial f^-}\}}{\left[\{^+(1-\alpha)\frac{\partial u(f^+)}{\partial f^+} - \{^-(\alpha)\frac{\partial u(f^-)}{\partial f^-}\right]} \right) \frac{\partial g(r)}{\partial r_i} \quad (\text{B-4})$$

Where the inequality condition has been introduced to account for potential discontinuity in the punishment function. For convenience sake it is assumed that the second order conditions determine a unique maximum for the value function.