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Participation, compliance and synergies at the farm level between the single payments scheme and farm certification labels

Christine Wieck
University of Bonn, Institute for Food and Resource Economics, Bonn, Germany
chrsitine.wieck@ilr.uni-bonn.de

Dominic Norbert Annen
University of Bonn, Institute for Food and Resource Economics, Bonn, Germany
dominic.annen@ilr.uni-bonn.de

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Abstract

Most European farmers receive direct payments under the Single Payment Scheme and in addition, are member of farm certification schemes. Incentives to participate in these schemes are manifold: farm requirements often at least partially overlap, farm structure allows rather easy compliance, but also low monitoring intensities, detection rates, or sanctions may contribute to "free ride" on participation. The paper develops a theoretical model that explains farmer's joint compliance behaviour and determinants of participation and tests the model using individual farm survey data. Evidence from the survey indicates that farmers weigh the relevance of compliance, control, detection and sanctions differently for the Single Payment Scheme and farm certification but strive to comply with all rules. Hence, potentially expected trade-off between costs and gains of participation and related compliance behaviour only partially occurs.

1   Introduction

The EU Single Payment Scheme (SPS) requires that all farmers receiving the single farm payment (SFP) need to respect Cross Compliance (CC) conditions defined in the fields of environment, food safety, and animal health and welfare (EU Commission, 2003). Farmers will be sanctioned for not complying with these standards through cuts in their direct payments. Controls are undertaken by the responsible administrative governmental body, but with a very low frequency as only about 1% of the farms are controlled in a given year (European Council,

2003). At the same time, many farmers are members of private farm certification schemes[1] (FCS) either because they want to signal a special quality they produce on their farm (e.g. "organic") or because they are "voluntarily" pushed to participate by the marketing partners as their products would not be bought in case of non-participation (e.g. "QS" for pig meat in Germany). Controls of these privately set standards are generally carried out by private organisations, are much more frequent than CC controls, and cover all farms that participate in a specific certification scheme. However, contrary to CC obligations, the requirements imposed by FCS usually only focus on farm activities that are targeted by the specific FCS. In case of the German "QS label" for example, their requirements may be relevant for pig production on the farm, but the arable production part of the farm is not subject to control. Here, CC has a much broader scope. Nevertheless, the two systems overlap with respect to the defined standards and their enforcement and synergies may exist that allow reducing the administrative burden of farmers and controlling costs for the respective agencies (Farmer *et al.* 2007).

Though CC is a compulsory policy instrument for all farms receiving the SFP, farms may decide to opt out of the system, i.e. forego the direct premium and CC controls. This happens on some specialized horticultural farms for example as the relation between administrative burden and financial reward is too unbalanced. In addition, there may be commercial livestock farms that do not participate in the SPS. Thus, for farmers, the decision to participate in the SPS and comply with CC and FCS may differ depending on their production and marketing situation, level of the SFP and other socio-economic conditions and personal goals. Similarly, there may be incentives for farms to join a specific FCS because CC and FCS obligations overlap significantly or because past farm orientation, management and buildings allow rather easy compliance. But also low monitoring intensities, detection rates, or sanctions in CC or a FCS may be an incentive to "free ride" on the participation when the farmer can expect that non-compliance will potentially not be detected or fined.

In the literature, not many attempts have been made to model these decisions about participation in the SPS or FCS from a farmer's perspective. Bartolini *et al.* (2008) is to our knowledge the only paper, that addresses this joint decision problem but in the context of participation in voluntary agri-environmental schemes (AES). In their theoretical analysis they distinguish, based on maximisation of expected farm profit, four strategies the farmer can take in this situation: no involvement in CC or AES; compliance with CC and no participation in AES; no compliance of CC and participation in AES; and compliance with CC and participation in AES. In an application of the methodology, they simulate the compliance with a nitrate directive in a specific region in Italy assuming six different farm types where the costs of compliance differ. In addition, they parameterise the monitoring intensity of the administrative body. Their results show that all farm types are interested in receiving the direct payments related to CC and that they

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[1] Sometimes, these schemes are also associated with the term "quality assurance schemes".

have an incentive to cheat regarding compliance. The similar effect is found for the participation in AES. Only when monitoring is sufficiently high, compliance with the obligations can be increased. Raggi *et al.* (2008) analyses the design of CC controls taking into account the moral hazard problem. They model the farmers' optimal level of cross-compliance assuming a specific monitoring intensity by the competent authorities. They also allow for non-compliance by the farmers but assume that this can be perfectly detected with a sufficient control effort by the authorities. Nitsch and Osterburg (2008) focus on the control effort by the authorities and develop a theoretical model based on the control theory. Taking the state perspective, they argue that the three variables control rate, probability of detection and height of sanction are the relevant ones to be optimized by the state in order to define efficient enforcement strategies for CC. From the point of view of the addressee, i.e. the farmer, they combine benefit-cost calculation of compliance with personal moral convictions and considerations of social sanctioning as the relevant variables that enter the farmer's decision process. Without empirically validating their theoretical model, they finish the paper with a discussion of the characteristics of different control systems for CC and specialised controls in the EU. In a theoretical paper, Herzfeld and Jongeneel (2012) provide a literature overview on various approaches from economics, psychology and sociology to explain compliance behaviour and put these approaches then in the asymmetric farmer-regulator setting of CC. They conclude by highlighting the need for further empirical research based on models that go beyond the assumption of utility maximizing agents and include other reasons for compliant behaviour. These reasons may include intrinsic motivations, moral convictions, or social preferences apart from economic cost-benefit considerations. The synergies in standards among CC and FCS were analysed by Farmer *et al.* (2007) and Annen *et al.* (2011). Farmer *et al.* (2007) show in a broad analysis of CC and FCS across EU member states that there exist significant synergies between the two sets of standards but also points out that there are key differences: for example, most FCS do not cover the full range of standards that are governed by CC obligations. Annen *et al.* (2011) show for the case of animal welfare standards in German and Austrian FCS that there exist wide similarities between FCS standards and CC and that farms being member of a FCS do comply with the relevant CC animal welfare obligations. Not directly focusing on CC but related in terms of theory is the literature dealing with participation and compliance to AES, mostly focusing on issues related to information asymmetries (Ozanne and White (2007), moral hazard and adverse selection (Hart and Latacz-Lohmann 2005) or uncertainty (Yano and Blandford 2011).

Focusing on the explanation of the participation and compliance behaviour of farms regarding CC[2] and FCS, our paper provides several contributions to the

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[2] We use interchangeable the terms participation in SPS and CC, as these two instruments cannot be independently applied. Officially correct is the terminology of "participation in SPS", as this refers to the overall policy system, but as the farm obligations to comply with are provided by the CC

literature that go beyond the above presented state-of-the-art. In the first section, the paper develops a comprehensive theoretical model accounting for this joint decision on CC and FCS under different monitoring and sanctions scenarios that are relevant and consider the current CC legislation. In a second step, the theoretical model is then tested using the results from a unique Austrian farm survey. The survey offers compliance control information from about 65 animal farms as well as further information sampled in the form of on-farm interviews about their behaviour facing both CC and FCS obligations, their knowledge and expectations regarding control and sanctions, but also with respect to personal beliefs, risk behaviour and past and planned investment decisions related to compliance with the obligations.

The paper proceeds in Section 2 by discussing overlap and divergence between CC and FCS standards followed in Section 3 with a derivation of a theoretical model and testable hypotheses for farm decision making when facing different systems of standards. Section 4 contains the empirical analysis providing an overview on the farm survey and the analysis of the results using descriptive and econometric methods. Section 5 discusses the hypotheses in the light of the survey results and Section 6 concludes.

2 The relationship of public and private farm standards

2.1 Standards as laid out by cross compliance regulations

With the Luxemburg Reform of 2003[3] the farm allocation of direct payments was linked to the farmer's adherence to CC farm standards. The obligations imposed by CC relevant directives can be distinguished into the standards of "Good Agricultural and Environmental Condition" (GAECs) and "Statutory Management Requirements" (SMRs). The GAECs are defined by the member states and set requirements for farmers with respect to soils, maintenance of landscape as well as habitat features that reflect characteristic environmental conditions of the member states' countryside.

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regulations, we actually prefer to use the term "participation in CC" as expresses more directly the obligations of the farmers.

[3] Given by Council Regulation (EC) No 1782/2003 of 29 September 2003 (European Council 2003) that is already replaced by Council Regulation (EC) No 73/2009 of 19 January 2009 (European Council 2009).

Table 1. Overview of the SMRs

Legal act with CC relevance	Relevant articles	Influence field	CC introduction
"Birds Directive": 79/409/EEC	3(1), (2)(b); 4(1), (2), (4); 5(a), (b), (d)	Environment	01.01.2005
"Groundwater Directive": 80/68/EEC	4; 5		
"Sewage Sludge Directive": 86/278/EEC	3		
"Nitrate Directive": 91/676/EEC	4; 5		
"Habitats Directive": 92/43/EEC	6; 13(1)(a)		
Council Directive 2008/71/EC	3 - 5	Public and animal health: identification and registration of animals	
Regulation (EC) No 1760/2000	4; 7		
Council Regulation (EC) No. 21/2004	3 - 5		
Council Directive 91/414/EEC	3	Public, animal and plant health	01.01.2006
Council Directive 96/22/EC	3(a), (b), (d), (e); 4; 5; 7		
Council Regulation (EC) No. 178/2002	14, 15, 17 (1), 18 - 20		
Council Regulation (EC) No. 999/2001	7; 11; 12; 13; 15		
Council Directive 85/511/EEC	3		
Council Directive 92/119/EEC	3		
Council Directive 2000/75/EC	3		
"Calves Directive": 91/629/EEC	3; 4	Animal welfare	01.01.2007
"Pigs Directive": 91/630/EEC	3; 4 (1)		
"Animal Protection Directive": 98/58/EC	4		

Source: Own representation based on European Council (2009).

The SMRs specify mandatory rules covering parts of 18 existing and already implemented regulations or directives with focus on the environment, public, animal and plant health and animal welfare and apply currently to EU-15, Slovenia and Malta (Table 1). Depending on their impact fields, the SMRs were stepwise introduced in the years 2005-2007. Nitsch and Osterburg (2007) provide an overview on the implementation of CC on member state basis. Member states must provide farmers with the list of SMRs, and must establish management, control and a sanction system to ensure sufficient monitoring with a minimum of 1% of farms checked on-site each year. The selection of farms for control in a given year shall be based on some risk-related criteria where the responsible agencies have leverage to define these criteria. Criteria such as change in farm ownership, enlargement or start of new farming activities and investment in buildings or land are often mentioned as factors influencing the farm specific risk score. When the SMRs or GAECs are not met by the farmer, the payments granted under the SPS ("direct payments") in the calendar year in which the violation occurs are reduced. The applied penalty rates vary depending on intent, extent, severity and permanence of the non-compliance, ranging from 1% to 15% in the event of negligence, to at least 15% where intentional violation can be assumed. In case of

repeated non-compliance, or breaches in several areas, penalties are cumulated and lead to a severe direct payment reduction. (European Commission 2011).

Relationship of CC with national law

Even if farms decide to opt out of the CC system, they still have to comply with relevant national law. In many areas, national law and CC obligations are congruent with each other: As all SMRs defined in CC, are formulated in pre-existing EU directives and regulations, they have already been incorporated into national law of the member states[4]. Thus their compliance by farms is automatic if farms adhere to all national law. The distinction between CC and national regulation lies in the fact that control frequency and sanctions are different, even though controls are executed by the same authorities, i.e. in most EU member states by the regional veterinary agencies. With respect to controls of abidance by national law, frequency of control is not exactly known by the farm and sanctions in the form of administrative fines are lower than in the CC case. The GAECs are principally "on-top" of national law. But depending on the EU member state or federal state they may be already covered by national rules, completely or to some extent. Hence, though farms not participating in CC are not obliged to comply with the GAECs they may face these GAEC regulations via national law.

2.2 Standards as defined by farm certification schemes

Many farms also comply with voluntary standards imposed by FCS. The farmer's main benefit of a membership in FCS is the permission to use a branded label serving to enter the market, to communicate the product quality and/or to achieve higher price premium. The obligations imposed by FCS vary depending on the responsible body, respective farming sector, livestock or crop type and scope of the scheme. Although FCS requirements for conventional or organic farms show in most cases strong overlap with the underlying conventional and organic legislative standards, they may respond to additional public concerns in the areas of animal welfare[5], food safety, wildlife conservation or of genetically modified crops. They are either formulated as recommendations or have compulsory character (Farmer *et al.* 2007). Costs incur not only by the regular membership or one-off joining fees of FCS, but also by adjusting farm management practices to meet the certification requirements, by regular audits or controls, as well as by sanctions in case of non-compliance.

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[4] However, national legislation may also exceed European law. For example, UK and Sweden exceed European law by prescribing group housing for non-suckling sows in all buildings (see e.g. Bock and van Huik 2007; Veissier *et al.* 2008, p. 283).

[5] Focusing on animal welfare, Veissier *et al.* (2008) provides a very good overview on the existence and relationship of public and private standards in that area. According to our knowledge, for the other areas, no such overviews do exist.

Table 2. Overview on characteristics of CC and FCS

Characteristic	Farm certification schemes	Cross compliance
Responsible body	Sectoral body, retailer, interest group, local administration	EU -> member states -> delegated authorities
Farming sectors	May be relevant to all production sectors or only specific areas of a farm.	All sectors except those ineligible for single payment (e.g. horses). Applies to entire holding if farm receives SFP.
Participation status	Voluntary	Compulsory if farm receives SFP.
Scope of standards	Varies by FCS standards. May relate to single, sector-specific standards or encompass many sectors or horizontal standards. Often includes mix of compulsory standards and best practice recommendations.	Basic horizontal standards for: Environment Food safety Animal and plant health Animal welfare
Costs of participation	One-off joining fee Annual costs of certification inspection Costs of compliance: Costs for adjustment of farm management practices to meet standards if not already met.	Costs of compliance: Costs for adjustment of farm management practices to meet pre-existing legal requirements/or new standards introduced with CC if not already met.
Benefits from participation	Certification often permits the use of a branded logo that allows access to special markets/niche and higher prices.	Entitlement to SFP.
Relation to jurisprudence	Schemes respect legal requirements as minimum basis, but coverage may not be comprehensive.	SMRs are based on national legislation, as mandated by EU legislation. GAEC standards may be based on national legislation.
Inspection	Inspection protocol is responsibility of the FCS body. Frequency of control varies but each single farm is inspected.	Responsibility of the responsible control authority. Controls occur annually on a minimum of 1% of the farms claiming the SFP.
Sanctions	Warnings and time for re-establishment of compliance. Withdrawal of certification and right to use logo.	Level of penalty depends on severity of the breach, but little to no scope to avoid sanction resulting in loss of part or full SFP.

Source: Own representation based on Farmer et al. (2007, p.19ff).

2.3 The relationship between CC and FCS standards

As displayed in Table 2, there are similarities with respect to the farming activities covered by both frameworks but also large differences between the two approaches. In general, the CC system defines horizontal standards in four areas that apply to all types of farming activities and participation is mandatory if the farm receives the SFP.

Participation in a FCS, however, is voluntary or "quasi-" voluntary and standards set by the FCS may be specific only to some areas and farm activities or may also be more horizontal depending on the scope of the label. In general, one may state that the CC standards define the legislative minimum standards defined for a specific area whereas FCS standards may go beyond this.

3 Model of farm decision making when facing cross compliance and farm certification system obligations

3.1 A model of joint participation and compliance

The SPS and related CC constitute a classical principal agent problem with asymmetric information between the participating agents and issues of moral hazard and adverse selection inherent in the design of the contractual relationship: The administrative body is the principal and does not hold all information about the behaviour of the agent (the farmer). The farmer has the possibility of cheating as the administrative agency can monitor the farmer's behaviour only imperfectly, because in practice full control is difficult and costly. To a lower extent, adverse selection may occur as farmers differ with respect to their personal convictions and attitudes toward cheating. Even though farm selection for CC control occurs according to risk-based criteria, the administrative regulator has no tool to discover the farmer's individual attitude towards cheating in advance in order to individually adjust the risk-based selection criteria to the expected level of farm compliance.

The behavioural model of the farmer in this decision situation can be represented as a problem where the farmer has to choose his strategy out of four possible schemes: exposition to national law (NAT), but no involvement in any of the systems (CC, FCS); membership only in one of the systems; and as a fourth case, simultaneous participation in both systems (CC+FCS). The optimal decision depends on the expected profit, the level of single farm payment but also on compliance costs resulting from the alignment of the production programme to the given standards, on farmer's expectations about control and detection rate of the monitoring agencies for CC or FCS and finally on expectations about the sanctions that may arise from non-compliance.

Formally, the farmers' behaviour may be stated as follows:

$$\pi_i = \max\left(\pi_i^{NAT}; \pi_i^{CC}; \pi_i^{FCS}; \pi_i^{CC+FCS}\right),\tag{1}$$

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where i represents the individual farmer, and the farm profits π_i stand for the maximum expected profit obtained by pursuing one of the different strategies outlined above.

Case 0 – General case: Definition of optimal farm production programme when no standards exist

Assume a case where the farmer has no outside regulations to comply with but is able to define her farm optimal production programme. This leads to the following maximisation problem:

$$\max_{y_i, e_i} \left\{ \pi_i^0 = py_i - C_i(y_i, e_i, w) \right\},\tag{2}$$

where π_i^0 represents the farm profit, y_i represents a vector of farming activities and p a vector of corresponding output prices. e_i represents the level of one specific farm characteristic (e.g. space in animal barn) a farmer would choose when no regulation exist but which may be subjected to a standard in certain regulatory frameworks. It is assumed that $e_i > 0$. $C_i(\bullet)$ defines a well-behaved, theory consistent cost function (Chambers 1998, p. 51f.) and depends on y_i, e_i and input price vector w. Costs are assumed to be convex in the level of the farm characteristic considered.

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The first order conditions of this farm maximisation problem represent:

$$\text{Optimal production programme: } \frac{\partial \pi_i^0}{\partial y_i} = p - \frac{\partial C_i(\bullet)}{\partial y_i} = 0,\tag{3}$$

$$\text{optimal level of realisation of farm characteristic: } \frac{\partial \pi_i^0}{\partial e_i} = -\frac{\partial C_i(\bullet)}{\partial e_i} = 0,\tag{4}$$

where equation **Fehler! Verweisquelle konnte nicht gefunden werden.**(4) simply says that the level of the farm characteristic should be such that the cost of realisation is (ceteris paribus) minimal.

Case 1 – National law

Now, we assume that the farm is subjected to national law but does not receive the SFP premium or participates in a FCS. This leads to the following farm profit formulation:

$$\max_{y_i, e_i} \left\{ \pi_i^{NAT} = py_i - C_i(y_i, e_i, w) - m_i^{NAT}(d_i^{NAT})\phi^{NAT} \right\},\tag{5}$$

where d_i stands for the degree of compliance a farm achieves for a specific level of a farm characteristic and is defined as:

$$d_i^{NAT} = \frac{e_i}{\overline{e}^{NAT}},$$

where $\overline{e}^{NAT}$ represents the regulatory level of the standard as defined by national law. The degree of compliance is modelled as a continuous variable with $d_i^{NAT} > 0$ and is specific to each regulatory framework. ϕ marks the fine that is imposed if non-compliance is detected.

$m(d_i)$ is the probability of detecting an infringement and is defined as the product of the probability c of the farm to be controlled in a given period and the probability h that an infringement is discovered when a control takes place: $m_i^{NAT}(d_i^{NAT}) = c_i^{NAT} \cdot h^{NAT}(d_i^{NAT})$. Similar to the degree of compliance, c_i, h_i and m_i are specific to each regulatory framework.

The probability of control is farm specific and depends on a number of (risk-based) factors defined by the respective control agencies as explained in Section 2. The probability to be caught is the same across all farms within a regulatory framework but depends on the farm-specific degree of compliance. This conditional probability to be caught decreases with higher levels of compliance,

i.e. $\dfrac{\partial h^{NAT}(d_i^{NAT})}{\partial e_i} \leq 0$,

because it is more difficult to detect breaches when a high degree of compliance is already achieved. Consequently, the unconditional detection probability also decreases with the degree of compliance,

i.e. $\dfrac{\partial m_i^{NAT}(d_i^{NAT})}{\partial e_i} = c_i^{NAT} \cdot \dfrac{\partial h^{NAT}(d_i^{NAT})}{\partial e_i} < 0$.

With respect to the relation between degree of compliance, control, discovery and detection, the following holds (Table 3):

Table 3. Relation between degree of compliance and detection probability

Degree of compliance	Resulting probability of discovery	Control probability	Resulting probability of detection
$d \geq 1$	=> $h(d)=0$	c=0	=> $m(d)=0$
		c>0	
$d < 1$	=> $h(d)>0$	c=0	=> $m(d)=0$
		c>0	=> $m(d)>0$

Note: For reasons of clarity, the subscript i has not been added in this table.
Source: Own representation.

When full compliance is achieved, i.e. $d_i \geq 1$, probability of discovery is zero, and regardless of the control probability, the detection probability is zero (non-positive) as there is no infringement to detect. When the degree of compliance is

less than one, the probability of discovery is larger zero. If the probability of control is zero, the resulting detection probability must also be zero as no control will take place, otherwise, if the control probability is larger zero, then also the probability of detection is larger zero.

The first order conditions of the farm maximisation problem in (5) are

$$\frac{\partial \pi_i^{NAT}}{\partial y_i} = p - \frac{\partial C_i(\bullet)}{\partial y_i} = 0, \tag{6}$$

$$\frac{\partial \pi_i^{NAT}}{\partial e_i} = -\frac{\partial m_i^{NAT}(d_i^{NAT})}{\partial e_i}\phi - \frac{\partial C_i(\bullet)}{\partial e_i} = 0$$

$$\Rightarrow \frac{\partial C_i(\bullet)}{\partial e_i} = -\frac{\partial m_i^{NAT}(d_i^{NAT})}{\partial e_i}\phi. \tag{7}$$

Equation (7) says that the marginal costs for an increased level of a specific farm characteristics, shall not exceed (must be equal to) the expected fine.

Costs of compliance occur when a farm has to change its production programme from its optimal state (case 0) in order to (fully) fulfill given legislation for a specific farm characteristic. This implies that additional costs of compliance to a standard only occur, if compliance involves a higher standard level than what the farm realizes "voluntarily" for that specific characteristic. Compliance with a standard may involve both, adjustments in the outputs with related changes in revenue and additional costs that occur due the regulatory requirement. So, costs of compliance are measured as the difference in profit between the "ideal" production programme and the realized one, e.g. $\pi_i^{NAT} - \pi_i^0$.

Table 4: States and costs of compliance for case 1

State of compliance	Assumption about control probability	Resulting profit loss ("costs of compliance")
Compliant to standard	Not relevant	None
Non-compliant to standard	$c_i^{NAT} > 0$	Exist
	$c_i^{NAT} = 0$	None

Source: Own representation.

When only national law exists, two *states of compliance* can be distinguished: the farm is compliant or non-compliant (Table 4). In the first state, a farm is fully or even "over-compliant" when the farm characteristic meets at least the level defined by the standard, i.e. $e_i \geq \overline{e}^{NAT}$. The maximisation problem reduces to case 0. No costs of compliance occur as the maximisation problem of equation (5) lead to the same profit as in case 0. If the farm operates with a specific

farm characteristic below a defined standard level, $e_i < \overline{e}^{NAT}$, the farm is considered to be non-compliant ($d_i < 1$). Further assuming $c^{NAT} > 0$, the detection probability is larger zero (compare Table 3), and thus equation (7) describes the decision behaviour for the realisation of the farm optimal level of e_i considering the expected fine. Compared to the "ideal" case, costs of compliance, $\pi_i^{NAT} - \pi_i^0$, occur and are negative. This finding is in line with reality, as we observe that quite a number of farms have no or only few costs of compliance for a wide range of standards as their farm-specific optimal level of compliance lies beyond the (minimum) requirements formulated in national law (Annen *et al.*, 2011). If the control probability is zero, then, the detection probability is equal zero and no costs of compliance occur as equation (7) reduces to the expression in case 0.

Case 2 – Participation in the Single Payment Scheme

If the farmer decides to receive the EU SFP, she is obliged to follow the CC requirements. Thus the farmer declares her willingness to accept premium reductions in case of non-compliance with these standards. At the same time, the farm has to follow national law, as explained in Section 2. As the principles of compliance, control, discovery and detection are the same for national law and CC, all definitions are according to case 1, but symbols are marked with the subscript CC. If non-compliance is detected, a sanction calculated as a function of the single farm payment is imposed, where ρ^{CC} represents the share of the payment that will be subtracted as a result of non-compliance. The farm maximisation problem may be stated as follows:

$$\max_{y_i, e_i} \left\{ \pi_i^{CC} = py_i - C_i(y_i, w, e_i) - m_i^{NAT}(d_i^{NAT})\phi + SFP_i - m_i^{CC}(d_i^{CC})\rho(d_i^{CC})SFP_i \right\}$$

(8)

The first order conditions read:

$$\frac{\partial \pi_i^{CC}}{\partial y_i} = p - \frac{\partial C_i(\bullet)}{\partial y_i} = 0,$$

(9)

$$\frac{\partial \pi_i^{CC}}{\partial e_i} = -\frac{\partial C_i(\bullet)}{\partial e_i} - \frac{\partial m_i^{NAT}(d_i^{NAT})}{\partial e_i}\phi - \frac{\partial m_i^{CC}(d_i^{CC})}{\partial e_i}\rho(d_i^{CC})SFP_i = 0$$

$$\Rightarrow \frac{\partial C_i(\bullet)}{\partial e_i} = -\frac{\partial m_i^{NAT}(d_i^{NAT})}{\partial e_i}\phi - \frac{\partial m_i^{CC}(d_i^{CC})}{\partial e_i}\rho(d_i^{CC})SFP_i.$$

(10)

Thus, in this case, equation

$$\frac{\partial \pi_i^{CC}}{\partial e_i} = -\frac{\partial C_i(\bullet)}{\partial e_i} - \frac{\partial m_i^{NAT}(d_i^{NAT})}{\partial e_i}\phi - \frac{\partial m_i^{CC}(d_i^{CC})}{\partial e_i}\rho(d_i^{CC})SFP_i = 0$$

(10says

$$\Rightarrow \frac{\partial C_i(\bullet)}{\partial e_i} = -\frac{\partial m_i^{NAT}(d_i^{NAT})}{\partial e_i}\phi - \frac{\partial m_i^{CC}(d_i^{CC})}{\partial e_i}\rho(d_i^{CC})SFP_i .$$

that the marginal costs for an increased level of a farm characteristic, shall not exceed (must be equal to) the marginal expected sanction comprising the fine for non-compliance with national law and for the SFP.

Costs of compliance are defined as the difference in profit between the "ideal" production programme and the realized one, i.e. $\pi_i^{CC} - (\pi_i^0 + SFP_i)$. We have added now the SFP[6] also to the "ideal" case, as we assume that the farm is participating in the SPS. With respect to the *states of compliance*, the following relations of standards and farm compliance exist in the EU:

a) General case: National law is equal to CC requirement, i.e. $\overline{e}^{NAT} = \overline{e}^{CC}$. Thus, the farm realisation of the standard may be above the requirement, $e_i \geq \left(\overline{e}^{NAT} = \overline{e}^{CC}\right)$, i.e. the farm is compliant with the standard, or below, $e_i < \left(\overline{e}^{NAT} = \overline{e}^{CC}\right)$, meaning that the farm is non-compliant.

b) There exist exceptions to that rule in some member states (e.g. Austria): The standard according to national law is higher than the same standard according to CC, i.e. $\overline{e}^{NAT} > \overline{e}^{CC}$.

This leads to three different options for the farm compliance behaviour:

- The farm is compliant to both standards: $e_i \geq \overline{e}^{NAT} > \overline{e}^{CC}$.

- The farm is compliant only to the lower standard, i.e. compliant to the CC requirement but not to the national law regulation: $\overline{e}^{NAT} > e_i \geq \overline{e}^{CC}$.

- The farm is non-compliant to both standards: $\overline{e}^{NAT} > \overline{e}^{CC} > e_i$.

Thus, overall, we have three states: full compliance to both standards, no compliance to both standards, or compliance to CC but not to national law. The costs of compliance expressed as expected loss in profit relating to these states are represented in Table 5.

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[6] In the formulas, the SFP is defined as being specific for each farm *i*. Nevertheless, in the text, we suppress the subscript *i*, as here, we understand the term generic representing the abbreviation of "Single Farm Payment".

Table 5: States and costs of compliance for case 2

State of compliance	Assumption about control probability	Resulting profit loss ("costs of compliance")
Compliant to both standards	Not relevant	None
Non-compliant to both standards	$c_i^{NAT} > 0$, $c_i^{CC} > 0$	Exist, larger than in case 1.
	$c_i^{NAT} = 0$, $c_i^{CC} = 0$	None
Compliant to CC but not to national law	$c_i^{NAT} > 0$, not relevant for CC	Exist, same as in case 1.
	$c_i^{NAT} = 0$, not relevant for CC	None

Source: Own representation.

It can be seen that costs of compliance only accumulate when the degree of compliance is below one for one or both of the standards and when the threat of a control exists (control probability larger zero). When non-compliance to both standards is detected, the potential sanction resulting from both systems is higher and the subsequent profit loss is larger than when only one standard is neglected or no infringement takes place. When the control threat is not credible, i.e. control probability zero, farms may be non-compliant without impacts on their profit. From a regulator's perspective this means an unwanted result that should be prevented by ensuring a sufficiently high control probability and control frequency.

Case 3 – Participation only in FCS and not in Single Payment Scheme

The next situation to be discussed relates to the farmer's decision of participation in a FCS without participating in the SPS. Here the farm has to comply with standards set by the respective FCS. The reward from participating in a specific FCS means that the farm can sell its products under the respective label and usually receives a higher price. This increase in profit due to the farmer's membership in the label is indicated by δ^{FCS} where $\delta^{FCS} > 0$. As in the case of CC, the individual farmer has the decision to which degree he wants to comply with the standards. Control of the standards take place by authorized control agencies where the monitoring procedure is clearly defined in the FCS guidelines. We assume the same principles for compliance and detection as in the previous cases and use the same symbols attached with the superscript FCS. As previously, levels of probability and frequency of controls may differ across regulatory frameworks and farms. In the FCS case, control often depends on past levels of compliance on the farm as for example the "QS" label distinguishes a one, two and three year control frequency depending on past results. The sanction in case of non-compliance to the standards of a FCS means in the most drastic case that the use of the label for marketing will be revoked and thus that the farm has to market its product in the standard conventional channel with subsequent financial conse-

quences. Also in this case, farms have to respect national law, but FCS controls are generally independent of national controls.[7] This results in the following profit maximisation formulation:

$$\max_{y_i, e_i} \left\{ \pi_i^{FCS} = \left(1 + \left(1 - m_i^{FCS}(d_i^{FCS})\right)\delta^{FCS}\right) py_i - C_i(y_i, e_i, w) - m_i^{NAT}(d_i^{NAT})\phi^{NAT} \right\}.$$

(11)

The first order condition reads:

$$\frac{\partial \pi_i^{FCS}}{\partial y_i} = \left(1 + \left(1 - m_i^{FCS}(d_i^{FCS})\right)\delta^{FCS}\right) p - \frac{\partial C_i(\bullet)}{\partial y_i} = 0,$$

(12)

$$\frac{\partial \pi_i^{FCS}}{\partial e_i} = -\frac{\partial m_i^{FCS}(d_i^{FCS})}{\partial e_i}\delta py_i - \frac{\partial C_i(\bullet)}{\partial e_i} - \frac{\partial m_i^{NAT}(d_i^{NAT})}{\partial e_i}\phi = 0,$$

$$\Rightarrow \frac{\partial C_i(\bullet)}{\partial e_i} = -\frac{\partial m_i^{FCS}(d_i^{FCS})}{\partial e_i}\delta py_i - \frac{\partial m_i^{NAT}(d_i^{NAT})}{\partial e_i}\phi$$

(13)

Thus, marginal costs of increasing the level of the considered farm characteristic must be equal to the marginal expected sanction imposed.

Loss in profit due to compliance, i.e. *costs of compliance*, compared to the "ideal" production programme are $\pi_i^{FCS} - \pi_i^{0,\delta}$, where we assume that the output price in the ideal production programmes are now adjusted for the premium that farms receive when participating in a FCS. Costs of compliance, as before may result from adjustments in the production programme or changes in production costs. We may observe the following *states of compliance*:

a) FCS standard is equal to national law, i.e. $\overline{e}^{FCS} = \overline{e}^{NAT}$.
   Thus, the farm realisation may be above the standard, $e_i \geq \left(\overline{e}^{FCS} = \overline{e}^{NAT}\right)$, or below, $e_i < \left(\overline{e}^{FCS} = \overline{e}^{NAT}\right)$
b) FCS standard is higher than national law: $\overline{e}^{FCS} > \overline{e}^{NAT}$.

This leads to three different options for farm compliance:

- The farm is compliant to both standards: $e_i \geq \overline{e}^{FCS} > \overline{e}^{NAT}$.
- The farm is compliant only to the lower standard, i.e. national law: $\overline{e}^{FCS} > e_i \geq \overline{e}^{NAT}$.

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[7] Private control agencies usually have notification requirement to public authorities if public and food safety is affected. Given the EU wide repercussions of the recent dioxin food safety scandal in Germany, we may observe changes in the future regarding the responsibilities of private and public control agencies.

- The farm is non-compliant to both standards: $\overline{e}^{FCS} > \overline{e}^{NAT} > e_i$.

Thus, overall, we observe three states: full compliance to both standards, no compliance to both standards, or compliance to national law but not the FCS standard. The costs of compliance expressed as expected loss in profit are represented in Table 6.

Again, costs of compliance only occur when the degree of compliance is below one for one or both of the standard types and when the threat of a control exists. When non-compliance to both standards is detected, the costs of compliance are largest compared to when only one standard is neglected or no infringement takes place. When the control probability zero, farms may be non-compliant without impacts on their profit as the farm can continue to sell the products under the FCS label. With respect to overall costs of compliance in the FCS system, it is to assume that the loss of the marketing premium due to non-compliance is the lowest when the FCS standard is very similar to the national one. For FCS standards that are much higher than national ones, the marketing margin is likely high as well and thus the incentive not to lose this advantage will be indirectly reflected in the costs of compliance.

Table 6: States and costs of compliance for case 3

State of compliance	Assumption about control probability	Resulting profit loss ("costs of compliance")
Compliant to both standards	Not relevant	None
Non-compliant to both standards	$c_i^{NAT} > 0$, $c_i^{FCS} > 0$	Exist, larger than in case 1.
	$c_i^{NAT} = 0$, $c_i^{FCS} = 0$	None
Compliant to national law but not to FCS	$c_i^{FCS} > 0$, not relevant for NAT	Exist, but smaller than cost of compliance when non-compliant to both standards. Depends on marketing margin and difference between national and FCS standard.
	$c_i^{FCS} = 0$, not relevant for NAT	None

Source: Own representation.

Case 4 – Participation in both: SPS and FCS

The final issue relates to the farmer's decision problem when participating in the SPS and thus being obliged to CC and additional participation in a FCS. Hence, the elements and assumptions from the previous cases are combined to reflect this situation. The resulting farm profit maximisation problem is given by:

$$\max_{y_i, e_i} \left\{ \begin{array}{l} \pi_i^{CC+FCS} = \left(1 + \left(1 - m_i^{FCS}(d_i^{FCS})\right)\delta^{FCS}\right)py_i - C_i(y_i, e_i, w) \\ \quad - m_i^{NAT}(d_i^{NAT})\phi^{NAT} + SFP - m_i^{CC}(d_i^{CC})\rho(d_i^{CC})SFP_i \end{array} \right\}, \quad (14)$$

with first order conditions:

$$\frac{\partial \pi_i^{FCS}}{\partial y_i} = \left(1 + \left(1 - m_i^{FCS}(d_i^{FCS})\right)\delta^{FCS}\right)p - \frac{\partial C_i(\bullet)}{\partial y_i} = 0, \quad (15)$$

$$\frac{\partial \pi_i^{FCS}}{\partial e_i} = -\frac{\partial m_i^{FCS}(d_i^{FCS})}{\partial e_i}\delta py_i - \frac{\partial C_i(\bullet)}{\partial e_i} - \frac{\partial m_i^{NAT}(d_i^{NAT})}{\partial e_i}\phi$$

$$\quad - \frac{\partial m_i^{CC}(d_i^{CC})}{\partial e_i}\rho(d_i^{CC})SFP_i = 0$$

$$\Rightarrow \frac{\partial C_i(\bullet)}{\partial e_i} = -\frac{\partial m_i^{FCS}(d_i^{FCS})}{\partial e_i}\delta py_i - \frac{\partial m_i^{NAT}(d_i^{NAT})}{\partial e_i}\phi$$

$$\quad - \frac{\partial m_i^{CC}(d_i^{CC})}{\partial e_i}\rho(d_i^{CC})SFP_i. \tag{16}$$

The optimal level of compliance combines elements from cases 1-3 indicating that marginal costs of adjusting the level of the production characteristic considered are now driven by all relevant standards. *Costs of compliance* are defined according to the previous cases, i.e. $\pi_i^{CC+FCS} - (\pi_i^{0,\delta} - SFP_i)$ with the same assumptions as before. With respect to the *states of compliance*, we may observe the following:

a) Full compliance to all standards: $e_i \geq \left\{\overline{e}^{NAT}, \overline{e}^{CC}, \overline{e}^{FCS}\right\}$.

b) No compliance to any standard: $e_i < \left\{\overline{e}^{NAT}, \overline{e}^{CC}, \overline{e}^{FCS}\right\}$.

c) Partial compliance with the standards.

Table 7: States and costs of compliance for case 4

State of compliance	Assumption about control probability	Resulting profit loss ("costs of compliance")
Compliant to all standards	Not relevant	None
Non-compliant to all standards	$c_i^{NAT} > 0$, $c_i^{CC} > 0$, $c_i^{FCS} > 0$	Exist, larger than in all other cases.
	$c_i^{NAT} = 0$, $c_i^{CC} = 0$, $c_i^{FCS} = 0$	None
Only partial compliance	Control probability larger zero for specific case.	Exist, but size depends on marketing margin and difference between national and FCS standard.
	Control probability equal zero for specific case.	None

Source: Own representation.

As before, costs of compliance only occur when the degree of compliance is below one for at least one of the standard types and when the threat of a control exists and control also takes place (Table 7). When non-compliance to all standards is detected, the costs of compliance are largest compared to when only one standard is neglected or no infringement takes place. When the control threat is not credible, i.e. control probability is equal to zero, farms may be non-compliant without impacts on their profit.

3.2 Comparison of cases and hypothesis derivation

In the last section, the various cases of participation in CC and FCS and states and costs of compliance with the respective standards were discussed. Costs of compliance only occur when farms not automatically comply with the standards under their optimal production programme. The derivative of the profit function with respect to the level of the farm characteristic *e* becomes relevant when a credible control threat of a respective standard exists. The optimal realisation of a specific level of the farm characteristic under CC, FCS or both resemble each as they all depend on the detection probability, the degree of compliance as well as the imposed sanction if the respective standard is not met. The more schemes are relevant on the farm, the more terms related to detection and sanctions have to be considered in the compliance decision.

Given these theoretical derivations we can derive hypotheses about the farmer's behaviour regarding participation and compliance. The formulated hypotheses are divided into two blocks: Hypothesis one to three deal with the general choice to participate in cross compliance and farm certification programmes where the second block (hypothesis four to seven) focus on the decision regarding the degree of compliance.

Participation choice

- Hypothesis 1: Low costs of compliance to the CC and/or FCS standards determine farmers' decision to participate in the respective system(s).
- Hypothesis 2: High fines or detection probabilities determine farmer's decision not to participation in the system.
- Hypothesis 3: Standards close to the national minimum requirements lead farms to participate in CC or FCS system.

Degree of compliance

- Hypothesis 4: Farms expecting a higher detection probability, higher fines, or both, will show a higher degree of compliance with obligations resulting from CC and/or FCS.

- Hypothesis 5: Farmers may have motives to fully comply with the obligations that are not captured explicitly in the above presented approach as for example personal beliefs regarding authority of the government, animal welfare, risk aversion or societal status.

4   Evidence from Austrian farm survey

4.1   Farm survey overview

Using different avenues (agricultural research center, agricultural chamber, certification agencies and other contacts) 113 livestock farms in Austria were contacted of which 65 farms participated in the survey which was conducted in the year 2009. Thus, the survey is not representative of the farm population in Austria, but still provides meaningful insights on compliance behaviour of farmers. Out of the 65 farms, 61 farms were able to fully answer the questionnaire. The farms were distributed over Austria with 31 farms located in Styria, 12 farms in Lower Austria, 8 farms in Salzburg, four farms in Upper Austria and Tyrol, respectively, as well as two farms in Carinthia. Main production focus of 38 farms is beef fattening and dairy production, the remaining 23 farms generate most of the income with pig fattening. The farms all received direct payments from the EU, and hence are obligated to comply with CC regulations. In addition, 90% of the farms participated in one or more FCS, i.e. 55 farms. Out of these 55 farms, 36 farms or 65% are certified as organic.

The survey was done at the farm site in personal 1-hour interviews with the farmer. In addition, supported by an Austrian veterinary official, an inspection of the animal confinements was done and data collected that was used to calculate an animal welfare index (see Annen et al., 2011). Hence, apart from the results of the survey, also on-farm degrees of compliance with legal veterinary requirements could be assessed. The full survey (in German) can be found in the Annex.

4.2 Farmer's attitudes and behaviour towards CC and FCS

Attitude and knowledge about CC and FCS

General attitude towards CC was positive within the population of the questioned farmers with about 59% considering the introduction of the *CC system* as "somewhat" or "very useful" (q22)[8]. But also about 41% of the farmers claim the CC obligations to be "somewhat useless" (26%) or "completely useless" (15%). Nevertheless, about 79% of the farmers say that their knowledge level (q18) about CC is "average" (47%) or even "good" (32%), but also 3% of the farmers claim that they have no knowledge about it[9]. This finding was confirmed in question 17 where it was asked how CC obligations relate to national law. About 42% answered that CC obligations are widely captured already by national Austrian obligations, another 33% said that they are completely covered by national law whereas only 17% said that they are not or almost not captured by national regulations with the remaining respondents said that they don't know the answer.

Reasons for compliance and participation in CC and FCS

When it comes to compliance with the CC obligations (q58) the following ones are listed as main reasons for compliance (in descending order): prevention of SFP reduction (listed as important or very important by 93%), overlapping with FCS obligations (62%), concerns regarding animal protection (51%), concerns regarding consumer protection (48%), prevention of financial sanctions (33%) and endorsement of CC system (8%).

Turning to the comparison of the relevance of the CC and the FCS system, 66% of the sampled certified farmers answered that the compliance with the FCS (q53) has the highest priority for them where for only 12% the priority is on the CC obligations and 22% ranked both systems as equally important. When the farmers were asked to rank both systems by their financial importance (q55), the result tendencies were the same with an even slightly stronger importance on the FCS (77%) and an average increase in income (q61) due to the participation by about 9% (standard deviation of 11). Inquiring the reasons for participation in a FCS (q59), highest importance was assigned most often to "trust in the certificate" (74%), "improved marketing of products" (72%) and "increase in revenue" (70%), whereas the least importance was assigned most often to a potentially "reduced administrative control rate" (93%) and the "overlap with CC obligations" (95%). As other relevant reasons "minimum requirements in supply chain" (60%), "animal welfare considerations" (60%) and "organic/alternative way of living" (57%) were mentioned. For those 6 farms that are not certified (q64), 3 responded that they generally do not intend to enter a FCS with the most important reason listed (q65) being that the farm structure does not fit for such a

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[8] Number refers to question number in survey.

[9] Even though all farms actually receive direct payments!

standard. Other reasons mentioned were that some obligations were "counterpro-ductive" or that investment costs were too high.

Decision on degree of compliance

The decision about the degree of compliance seems to be an important one from a theoretical perspective. Two questions deal with this issue, asking if farmers do comply with all regulations and if they may intentionally not comply with some obligations (q56, q57). The survey reveals that about 33% of the farmers do not comply with some of the CC obligations, but that all of these cases of non-compliance result from the use of transition periods for specific obligations or problems with the structural design of the farm buildings. Similarly, according to the question about investments and degree of compliance (q40), all farmers expect to fulfil all obligations after the termination of all investments and construction projects. The on-farm inspection of CC made in the context of this survey revealed that the degree of compliance on average was 97% with 50% of the farms fulfilling all CC obligations already at the time of the survey. Hence, in practice, given the density of regulations relevant on the farm and the link of compliance with sanctions, the decision about degree of compliance seems not to be relevant. Supporting evidence is also the observation that 75% of the farmers state that they have made very positive (10%), positive (42%), or at least neutral (23%) experiences with EU law (q83) and that about 66% of the farmers said that considerations about legal conformity with current law play a certain role in their decisions (q84). In addition, about 85% of the surveyed farmers said that animal welfare and consumer protection play a large or very large role in their decision comply with the law.

Costs of compliance

As the most work and cost intensive obligations (q31), "cleanliness of housing facilities", "identification and registration of pigs" and "mutilation requirements for cattle" were named, where "cleanliness of housing facilities" received by far the highest number of checks (56%). 66% of the farmers ranked the administrative burden (q43) in the FCS to be the largest, whereas 25% said that the administrative work is the same in the CC and FCS systems. With respect to investments into animal production in the last five years (q32), farmers invested on average about 25.000-50.000 Euro, and for about 61% of the farmers, 11-30% of the money was necessary to fulfil all CC obligations (q33) and for about 40% of the farmers, 10% of the investments were needed to comply with certification standards (q35). Hence, in both cases, there existed also quite a number of farmers that did not do the investments for compliance purposes but for other reasons.

Monitoring, detection and sanctions

On average, the sampled farmers expect a CC *control* every third year (q46)[10]. The variation in expectation was striking with some farmers expecting a control only once in 20 years and others every quarter of the year. In reality, since the introduction of the CC system, about 36% of the farms have not been monitored, another 36% were controlled once and the remaining farms two to six times (q48). On 15% of the farms, non-compliance with one or more obligations was found where requirement about "maintenance of agricultural land" was the one with the most objections.

The expected *detection* rates in the various monitoring exercises (general farm control by veterinary agency, CC control, FCS control) are on average rather close and in the area of 81%-90% (veterinary agency) and 91%-100% detection rate in the respective CC and FCS controls, even though in the case of the FCS control about 65% of the farmers expect with a detection rate of 100% that non-compliance will be detected (contrary to only 45% in the veterinary control).

A cut in direct payments is by far the most deterrent *sanction* (q71), followed by a damage of their public image and an increase in the rate of CC control. Questioned about the expected reduction in SFP payment, farmers expected the premium to be reduced (q74) by about 6% on average for a first case of non-compliance in the area of animal welfare. For a repeated case of non-compliance they expected this rate to move up to about 13% on average. The highest reduction was expected for a deliberate case of non-compliance with a CC obligation with about 87% average reduction of the SFP. For FCS control (q72), the most deterrent sanctions were the expulsion from the certification system, followed by a contract penalty (as e.g. no use of the logo for a specific period of time) and a cost intensive additional control. Regarding indirect sanctions or effects on their societal status (q75), 44% said that the image loss when non-compliance with obligations is detected play a large role in their decision, and the prohibition of animal production in the future has an even more significant threat potential for 95% of the farmers. With respect to a potential increase in the control rate due to detected non-compliance, only 9% of the farmers responded that this impact significantly their decision. When asked about the reality of CC and FCS control on the sampled farms, the results where much less drastic: When non-compliance with CC obligations were found, in 87% of the cases no sanctions were imposed. Similarly, when deviations from FCS standards were detected in 14 of 20 cases no sanctioning was undertaken (q52). In the remaining six cases, a new control was scheduled.

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[10] Even though mean and median were close together, some expected a control only once in 20 years, others every quarter of a year.

Potential integration of the systems

Given the discussion about a potential integration of the CC and FCS system and the use of the monitoring results from one system to reduce the administrative control burden in the other system, the survey also included some questions regarding this topic. About 81% of the farmers think that a replacement of CC controls by FCS controls (q28) is "very useful" and also support in majority (81%) the idea that results from a FCS control should be used in CC monitoring (q25). Only 7% of the farmers were not willing to show results of FCS controls to the official monitoring bodies. This result strongly supports ideas to further consider the integration of existing certification schemes.

4.3 Determinants of participation in FCS

Next, we apply a limited dependent model approach to formally test the determinants of participation for the sample farms. Farmer's have to make a decision about participation in the SPS and about participation in a FCS. However, as the survey results reveal, also supported by simulations performed by Raggi *et al.* (2008), participation in SPS is important for farmers in financial terms but rather costless in terms of compliance for most farmers. The question to ask would be then, if farmer's degree of compliance depends on their risk aversion, financial abilities, moral considerations or other characteristics (as for example also assumed in Nitsch and Osterburg 2007). Nevertheless, also here, the survey revealed that after a transition period and additional investments, all farms will be 100% compliant with the regulations. This means that questions on the willingness of farmers to participate in FCS in addition to CC and the related degree of compliance are left. Given that we were not able to gather information on the degree of compliance to certification for our specific sample of farmers, only the willingness to participate (WTP) can be analysed subsequently. This WTP in FCS in addition to CC may be explained by determinants such as specialisation of the farm, investments in order to fulfil with the obligations, expectations about controls, or social factors such as age, education, risk behaviour, general believes.

For this kind of discrete binary choice problem, logit or probit models are well suited (Verbeek 2000) and both generally yield very similar results in empirical work (Verbeek 2000, p. 179). Hence, for reasons of convenience and previous experience, we focus on the standard normal distribution underlying the probit model. Our approach follows closely Defrancesco et al. (2007) and Vanslembrouck et al. (2002) in their empirical approach. Denoting the cumulative normal distribution as used in the probit model with $F(\bullet)$, the probability of participating in a FCS is defined as:

$$P(y_i = 1) = F(\Theta_i) \quad and \quad P(y_i = 0) = 1 - F(\Theta_i) \text{,} \qquad (17)$$

where $y = 1$ means that the farmer is willing to participate in a FCS, and $y = 0$ refers to the opposite, Θ is formed by the following variable based on the survey results as discussed in Section 4.2:

$$
\begin{aligned}
\Theta_i = \ & \beta_0 + \beta_1 Age + \beta_2 EDU + \beta_3 FType + \beta_4 LastINV + \beta_5 FutINV \\
& + \beta_6 ExpConCC + \beta_7 ExpDetecFCS + \beta_8 ExpSanImage + \beta_9 ExpSanIncCon \\
& + \beta_{10} Risk + \beta_{11} ExpeEU + \beta_{12} LegConf + \beta_{13} ANWELF \\
& + \beta_{14} CPROT + \beta_{15} LastPft + \beta_{16} DP
\end{aligned}
$$

$$(18)$$

The variable definitions follow from Table 8. The signs behind the variables indicate the expectations about their impact on the willingness to participate in FCS: (+/-) stands for a positive/negative impact and (~) indicates an a priori unclear effect.

Table 8: Variable definition

Variable name (related question in survey)	Variable type	Definition	Expect. impact
Age (q2)	Continuous	Years	~
EDU: Agricultural education (q4)	Categorical, ordered	1: Apprenticeship: 2: Certified technical farmer: 3: (Applied) University degree; 4: Other	+
FType: Farm type (q7)	Binary	Part (=0) or full time (=1)	+
LastINV: Farm investment in last 5 years (q32 with categories merged)	Categorical, ordered	1: 0€-50.000€; 2: >50.000€	+
FutINV: Investment in next 3 years (q37 with categories merged)	Categorical, ordered	1: 0€-10.000€; 2:> 10.000€-50.000€; 3: >50.000€-150.000€; 4 >150.000€	+
ExpConCC: Expected control rate CC (q46 with categories merged)	Categorical, ordered	1: >10 yrs; 2: >5-10 yrs; 3: 2-5 yrs; 4: <= 1 yrs	-
ExpDetecFCS: Expected detection rate FCS (q70 with categories merged)	Categorical, ordered	1: 91-100%; 2: 81-90%; 3: 71-80%; 4: >=70%	-
ExpSanImage: Expected indirect sanction: image loss (q75A)	Categorical, ordered	1: No relevance; 2: Small relevance; 3: Large relevance; 4: Very large relevance	-
ExpSanIncCon: Expected sanction: increased control rate (q75B)	Categorical, ordered	1: No relevance; 2: Small relevance; 3: Large relevance; 4: Very large relevance	-
Risk aversion (q76)	Categorical, ordered	1: Very averse; 2: Slightly averse; 3: Neutral; 4: Somewhat risky; 5: Very risky	~
ExpeEU: Experience with EU law (q83)	Categorical, ordered	1: Very bad; 2: Somewhat bad; 3: Neutral; 4: Somewhat good; 5: Very good	~
LegConf: Personal ethics regarding legal conformity (q84A)	Categorical, ordered	1: No relevance; 2: Small relevance; 3: Large relevance; 4: Very large relevance	~
ANWELF: Personal ethics regarding animal welfare (q84B)	Categorical, ordered	1: No relevance; 2: Small relevance; 3: Large relevance; 4: Very large relevance	+
CPROT: Personal ethics regarding consumer protection (q84C)	Categorical, ordered	1: No relevance; 2: Small relevance; 3: Large relevance; 4: Very large relevance	+
LastPft: Last profit (q89)	Categorical, ordered	1: Very bad yr; 2: Bad yr; 3: Average yr; 4: Good yr; 5: Very good yr	-
DP: Direct payments received	Continuous	Euros	-

Note: Direct payments were taken from public data base on direct support (Agrarmarkt Austria, 2010).
Source: Own representation.

In total, two variations of the above equation (18) were estimated with the second variant representing a reduced version where some insignificant variables were left out. This increased the overall fit of the equation and the significance of most of the remaining variables without inducing sign changes or large changes in the size of the coefficients. This indicates a certain stability of the identified relation

between the explanatory variables and the probability to participate in FCS. Nevertheless, also in the reduced equation, only age and farm type could be identified as being significant at the 10% level and with the expected sign in the case of farm type.

Table 9. Estimation results

Dependent variable: Participation in farm certification scheme (equal to 1 if participating, 0 = otherwise)
Number of observations: 61
Observations with dependent variable y=1: 55

	Full equation		Reduced equation	
Variable	**Coefficient**	**Probability**	**Coefficient**	**Probability**
Intercept	-3.65	*0.39*	-4.18	*0.14*
Age	0.12	*0.05*	0.12	*0.04*
Education	0.15	*0.66*	0.25	*0.46*
Farm type	2.76	*0.12*	2.26	*0.09*
Last investment	-1.21	*0.39*	-1.10	*0.36*
Future investment	-0.28	*0.49*	-0.28	*0.48*
Expected control rate CC	-0.17	*0.80*	-	-
Exp. detection rate FCS	-0.25	*0.57*	-0.30	*0.48*
Exp. sanction: Image loss	-0.11	*0.72*	-	-
Exp. san.: incr. controls	0.85	*0.23*	0.83	*0.29*
Risk behaviour	-0.75	*0.29*	-0.61	*0.34*
Experience EU law	0.34	*0.42*	0.50	*0.15*
Ethics: legal conformity	1.12	*0.33*	1.43	*0.17*
Ethics: animal welfare	0.29	*0.87*	-	-
Ethics: consumer protec.	0.38	*0.84*	-	-
Last farm profit	-0.04	*0.93*	-	-
Direct payments	-7.55E-05	*0.31*	-6.19E-05	*0.33*
McFadden R-squared	0.52		0.50	
Log likelihood	-9.40		-9.87	
Restr. log likelihood	-19.61		-19.61	
LR statistic	20.43		19.47	
Prob(LR statistic)	0.20		0.05	
% of correct predictions	93.44%		93.44%	

Source: Own estimation.

5   Discussion of hypotheses

Participation choice

Hypothesis 1 said that low cost of compliance drives farmer's decision to participate in CC or a FCS. Given the survey results, this hypothesis can be confirmed.

Using as a proxy for costs of compliance past or planned investments, the survey results reveal that CC as a system is overwhelmingly accepted and investments were done or planned only partially to comply with CC obligations, but compliance was still achieved. Also for participation in a FCS, only minor parts of the investments were done in order to fulfil FCS obligations but for other reasons. Financial importance of the FCS was ranked highest as well as the participation reasons "trust in the certificate", "improved marketing of products" and "increase in revenue". This means that cost of compliance were marginal compared to the financial incentives provided by participation in a FCS. Similarly, the probit model results indicate that full time farms tend to favour participation in a FCS which indicates that economic reasons underlie this decision.

Hypothesis 2 stated that expectations about high fines or detection probabilities indicate that farmers rather not participate in one or both of the systems. This hypothesis could not be confirmed. The few farmers that were not participating in a FCS, indicated as their main reason that the FCS requirements do not fit with their farm structure and specialisation.

The *third hypothesis* analyses whether standards close to the national minimum requirements lead farms to participate in CC or FCS system. In Austria in particular, for animal welfare requirements, national law is stricter than CC. This fact certainly drives participation in CC as it makes it easy for the farms to also apply for the SFP. This is confirmed by the finding that all farms in the survey participate in CC. With respect to participation in FCS, about 60% of the farmers said that they participated because these were minimum requirements in the production chain. Unfortunately, we cannot differentiate further how these minimum requirements relate to national law.

Decision about degree of compliance

Hypothesis 4 deals with the degree of compliance and its relation to expectations about controls, detection and sanctions. The survey shows that all farms aim at full compliance with all obligations even though rather different expectations about monitoring intensity exist. The additional assessment of on-farm degrees of compliance with legal veterinary requirements showed that most farms were compliant with all requirements (Annen *et al.*, 2011; Annen *et al.*, 2012). This shows that the objective to fully comply with all relevant regulation is not only an intention, but has also been achieved in practice on the farm. The survey further reveals that farmers on average expect to be controlled for CC obligations every third year. This question was not asked for FCS because the control rate is usually set in the codes of practice of the respective standards. Regarding detection rates, farmers expect rather high rates with about 80%-90% of all breaches to be found. The cut in direct payments and the expulsion from the certification system were considered as the most deterrent sanctions, even though in practice (especially in the FCS) first time cases of non-compliance did not lead to sanctions. Overall, the hypothesis can be confirmed as we observe high degrees of compliance as well as

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high expectations about intensity of controls and detections with little variance among the surveyed farms.

Hypothesis 5 about other motives to comply with obligations can be confirmed given the areas that were sampled in the survey. This means that image loss, prohibition of animal keeping, increase in control rate, risk aversion, legal conformity, animal welfare and consumer protection positively impact their decision to comply with the obligations even though a statistically significant impact could not be found in the econometric analysis.

6 Conclusions

A theoretical model is developed to analyse participation and compliance decisions and behaviour regarding cross compliance and farm certification obligations considering different monitoring and sanction scenarios. Using individual farm survey data from Austrian farms, several hypotheses derived from the theoretical model are tested. Theoretically, farmers have several choices: Participation in the SPS itself is a choice (where no participation means that the farm is exposed to national law only), as well as membership in one more FCS. Apart from that, the degree of compliance is also a potential decision variable. Low costs of compliance drive farmer's decision to participate in CC or a FCS. Expectations about the monitoring intensity and the sanctions in relation to the benefits of the scheme (i.e. single farm payment or marketing gain from private label use) decide about the optimal level of compliance where this decision is made independently for each scheme. Nevertheless, farmers do not think so strategically about compliance and costs of compliance but rather try fulfilling all obligations in order to avoid a penalty. High expectations about detection rates, personal convictions and other factors such as the image loss related to such a penalty seem to contribute to this behaviour. In addition, especially on animal farms, full compliance strongly depends on the physical structures of the farm and thus on (past) investment decisions. Once, these investments have been realized, compliance is achieved as long as no further changes in the standards occur. The survey revealed that farmers put more importance on compliance with FCS than CC as the FCS provides the larger financial incentives.

Regarding compliance and control of compliance, for farm certification schemes, another issue regarding participation has to be considered: Too strict certification controls disincentive farms from participation, but too lenient controls discredit the certification scheme. Hence, level of standards, monitoring intensity and participation influence each other indirectly, and farm certification schemes must be careful to keep the balance between popularity of a label and level of standards and control intensity. Farm certification organisations try to avoid this dilemma by assigning independent control agencies with the monitoring, but still the antagonism between high participation and strict standards exist. The analysis of Farmer *et al.* (2007, p. 66) already discussed this issue and noted that certification organisations support non-compliant farms usually by "providing time to rectify a breach before membership is withdrawn". This observation is

supported also by results of our survey where out of 20 farms found with breaches only six farms had to pay for a repeated control, and no case of membership withdrawal occurred.

Finally, apart from the compliance issue, the potential further integration and synergies of CC and certification systems is a topic that surface in public discussion from time to time. Our survey revealed that farmers are very in favor of actions that may reduce their administrative burden and that they think that the integration of CC and certification schemes is a practical idea. Also, about 90% of the farmers were willing to facilitate sensitive information about control results between public and private administrative agencies. This indicates the importance farmers assign to this issue, but still, from a broader perspective it is not clear how it could work in practice given that not all areas of CC are covered by specific FCS. Apart from the already raised problems in Farmer *et al.* (2007), this would mean that CC controls must have knowledge about the FCS and the areas they consider in their control. At the same time problems arise when infringements of FCS rules were detected: because some FCS obligations are higher than what is expected for CC, and thus, non-compliance with FCS rules does not necessarily mean that also CC obligations are not fulfilled. Hence, if the CC administration wants to make use of certification results, data exchange about levels of standards has to be very comprehensive and result assessment would probably need to be standardized so that CC level of compliance and higher levels can easily be assessed.

As a concluding result, even though one has to be careful to extrapolate from a farm survey in Austria with about 65 farmers to the farm population of the EU-27, it was discovered that farmers strive to fully comply with CC and FCS legislation whereas cheating seem to occur only to small extent. With respect to the streamlining of administrative burdens of different certification and compliance systems, there is broad acceptance about such an approach but feasibility has to be proven first. Further research analysing actual compliance behaviour of farmers may be desirable, as the small survey size as well as the farm selection mechanism may lead to a positive bias overestimating the compliance behaviour of the farms.

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