Determinants of pig farmers' participation in an animal welfare program

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Abstract

Despite frequent criticism, only few animal welfare attempts have been made towards an increase in terms of a dominant animal solution. Since farmers' willingnesstoengage in animal welfare attempts is crucial, this study investigates farmers' willingness-to-participate in an animal welfare program, which comprises a mandatory set of animal welfare measures. Data from a survey among members of a Northern German pig farmer cooperative has been used. With Theory of Planned Behavior as a theoretical framework a particularly analyze how single animal welfare measures influence farmers' willingnesstoparticipate has been run. Three groups of farmers are identified, namely, the "refusing" the "undecided" and the "acquiescing". The multinomial logit regression shows that while the refusing group is significantly more negative than the undecided about at least three of the eight required measures, the acquiescing group does not significantly differ from the undecided with respect to evaluation of measures. Rather, they exhibit a tendency to be more proactive, while the undecided feel more like being victims of societal pressure. The article concludes that it will be crucial to work on farmers' beliefs, with respect to feasibility as well as with respect to perceived locus of control.

Keywords: animal welfare, multinomial logit model, Theory of Planned Behavior, willingness-to-participate

1 Introduction

From a societal perspective pig welfare is perceived as too low The Scientific Advisory Board on Agricultural Policy to the German government even stated that the current way of pig farming has no future (Scientific Advisory Board on Agricultural Policy (WBA) 2015). To overcome this problem, besides stronger regulations, private as well as public solutions are sought through the setup of specific animal welfare programs. Such programs can be seen as a bundle of requirements for husbandry, feeding, transportation or slaughter, which can be all compulsory, as it is the case in a German label promoted by the Association for Animal Protection (TSB) or subject to some choice by the farmer, like the newly established Initiative for Animal Welfare ("Initiative Tierwohl"). Adoption of the both programs, however, is rather slow, and there is only a small number of studies available to explore farmers' readiness to participate in certain animal welfare programs.

Barriers to change have been invested to include both economic (cost of adoption and lack of consumers' willingness-to-pay) and behavioral (awareness, attitudes, and habitual) reasons. Hansson and Lagerkvist (2015), e.g., found that farmers' evaluation of dairy cow welfare improvements includes use and non-use values of animal welfare. Further, it has been shown that, even though farmers have positive attitudes towards animal welfare (Franz et al. 2012, Spooner et al. 2014), they might refuse the implementation of single animal welfare measures (Bock and van Huik 2007), and thus decline participation in schemes which include them as mandatory. Farmers' evaluations of individual husbandry requirements have been so far mainly captured by qualitative approaches (Bock and van Huik 2007, Dwane et al. 2013, Spooner et al. 2014), leaving room for further investigation, particularly with respect to program participation.

The research question addressed in this paper is: "How does the composition of animal welfare measures affect farmers' willingness-to-participate in a farm animal welfare program?". More specifically, the main focus of this research is farmers' willingness-to-participate in a fictive pig welfare program, where eight measures, including, among others, ban of tail docking and castration, provision of roughage and playing materials, are all mandatory. We use the framework of Theory of Planned Behavior (TPB, Ajzen 1991) to assess the attitudinal, normative, and control-related drivers and barriers for implementation of the single measures as determinants of farmers' willingness-to-participate.

The remainder of the paper is organized as follows. First, the addressed research gap based on literature reviews of farmers' drivers and barriers to upgrading pig production towards animal

welfare will be presented. Then, the theoretical framework of TPB as proposed for the study will be presented, followed by the explanation of the hypotheses, concluding with the measurement strategy and applied methods. The results will be presented and discussed with respect to their implications for the potential of private animal welfare programs.

2 Theoretical framework and hypotheses

Investigating the drivers and barriers of animal welfare program adoption among farmers requires going beyond pure economic incentives. In social sciences, social-psychological models have been developed to explain individual behavior. Among these, TPB is one of the most applied theories, which have been subject to numerous modifications and extensions in the past decades. In the following, a literature review on studies related to farmers' willingness to adopt farm animal welfare programs will be provided and the lack of applications of social-psychological theories will be shown. Followed by an explanation of the TPB and we derive our hypotheses.

2.1 Drivers and barriers to upgrade pig production towards animal welfare

Farmers' view on farm animal welfare has been investigated by both animal scientists and social scientists. We also find comparisons of farmers' and consumers' or citizens' attitudes in this respect (Deimel et al. 2012, Te Velde et al. 2002, Vanhonacker et al. 2009). In the following, we group the extant studies into three categories: A first group deals with general attitudes and perceptions of farmers regarding pig animal welfare, the second comprises studies which analyze intentions to improve husbandry, and the third group actually measures farmers' intentions to participate in animal welfare programs.

Among the studies dealing with general attitudes (first group), Franz et al. (2012) followed the systematic approach of the Welfare Quality project (Botreau et al. 2009) to describe animal welfare on the four dimensions of "good feed", "good housing", "good health" and "appropriate behavior". Major findings with respect to farmers' general attitudes and perceptions are that the current husbandry practices to a large extent fulfill farmers' requirements as to animal welfare (Deimel et al. 2012). It is acknowledged that there are bad examples mistreating their animals, but overall, it is perceived that the past decades have not only brought progress in terms of genetic performance potentials, but also in husbandry and management systems, which contribute to animal welfare (ibid.). Farmers often view fast growth as a sign of animal welfare and deem hygiene as crucial (Franz et al. 2012). However, there is not "the farmer": Franz et al. (2012) found three clusters of farmers, which have been typified as "Undecided", "Opponents to the behaviour-orientated approach" and "Open

minded combiners". Also, Kauppinen et al. (2012) found sub groups of farmers based on, among others, their attitudes toward the importance of treating animals humanely, or toward their own well-being. Further studies have shown that farmers feel rejected by society and in a trap between economic pressures and societal demands which they are requested to fulfill without compensation or reward (Deimel et al. 2012). Te Velde et al. (2002) has argued for the existence of a tacit agreement of collective non-responsibility between farmers and consumers, where both sides delegate their responsibility to the respective other and nothing has to be changed in the own behavior before the other party makes a move.

The second group of studies considers drivers of farmers investing in improved husbandry systems. It includes not only studies on pig (Kauppinen et al. 2012, Kirchner et al. 2014, Spooner et al. 2014), but also dairy farms (Bruijnis et al. 2013, Hansson and Lagerkvist 2015). Requests from non-governmental organizations to provide outdoor facilities are perceived as exaggerated and not necessary to ensure animal welfare (Deimel et al. 2012). The probably most innovative approach is provided by Kauppinen et al. (2012), who investigate whether farmers' attitudes toward improving animal welfare are related to actual animal productivity based on a survey among Finnish piglet farmers. They employ a TPB framework for capturing attitudes, subjective norms, perceived behavioral control and intentions (see the explanation below) and directly link these to the productivity information captured by production parameters which are unbiased with respect to biological influences. They analyzed bivariate relationships and indeed find that farmers with more positive attitudes yield better pig performance.

In the third group, with respect to particular animal welfare programs, there are some studies which try to identify drivers and barriers to adoption. Major barriers refer to a disbelief in the market potential, i.e., consumers' willingness-to-buy and to-pay (Bock and van Huik 2007, Dwane et al. 2013, Escobar and Buller 2014, Franz et al. 2012). Additional barriers that can determine participation in an animal welfare program may be farmers' fear of administrative burdens (Kirchner et al. 2014). The expectation that measures of the program could be subject to upcoming regulations, on the other hand, could drive farmers' willingness-to-participate (Bock and van Huik 2007, Escobar and Buller 2014). In the study by Franz et al. (2012), all three above-mentioned attitude-based clusters tend to reject participation in the fictive animal welfare program proposed by the researchers, with the "Open-minded combiners" being the least negative. A specific evaluation of single measures was not included in the survey. Thus, the reasons for farmers' rejection of the proposed program remain unclear. Given Franz et

al.'s (2012) strategy of measuring general attitudes, which do not directly relate to the later asked behavioral question of participation, it is not surprising that the clusters do not differ too much in willingness to adopt the program.

Against this background, we consider it relevant to investigate more intensely the potential drivers and barriers to participation in programs without flexibility in the choice of measures.

2.2 Theory of Planned Behavior

The TPB (Ajzen 1991), is based on the expectancy-value paradigm and conceptualized as comprising behavioral, normative and control beliefs. Behavioral beliefs refer to the expected outcome of an action, e.g., in our case, the likelihood of a husbandry measure to contribute to farm animal welfare. Normative beliefs are deemed to represent the perceived social pressure to carry out a certain action, and control beliefs reflect the perceived ease of carrying out the action, including the perception of internal versus external locus of control. Some authors also have measured control beliefs as perceived self-efficacy or self-identity (Sparks et al. 1997). A full employment of the concept requires not only asking for the likelihood that an action has a specific outcome, but also how the outcome is evaluated. Ajzen and Fishbein (2005) then postulate that for each belief, expectation and evaluation have to be multiplied, and the overall attitude is measured by the sum of these products. For subjective norm, the expectation of relevant others wanting the individual to carry out an action has to be multiplied with the motivation to comply, i.e., a person's wish to do what other people expect, and summed across all relevant others. Perceived behavioral control, finally, includes the summed products of control beliefs likelihood of an aspect hindering or facilitating a behavior, with the occurrence of this aspect in the individual's life. Besides these indirect measures, Ajzen and Fishbein also suggest a direct measure of attitudes, subjective norms and behavioral beliefs which comprises general judgements of the behavior. The procedure of multiplying and summing of expectations and evaluations has been criticized severely in the past for confounding effects and producing non-interpretable results (French and Hankins 2003). In the literature, we find numerous applications of the TPB which use the overall framework of distinguishing attitudes, norms and control, but do not employ the full measurement model. Recent extensions of the TPB include moral obligation and self-identity (Shaw et al. 2000). Later in this paper, we will also propose a slightly modified model, which sticks, however, to the basic framework of TPB.

2.3 Hypotheses to explain farmers' participation in animal welfare programs

In our study, we aim at a) improving the measurement of intention to participate and b) measuring salient beliefs with respect to the participation in a fictive animal welfare program. We rely particularly on the finding by Bock and van Huik (2007:937) that farmers, when complaining about their countries' animal welfare legislation, focused on "specific regulations and measures that were considered as detrimental to animal health and production performance or too difficult and costly to implement". Also Kauppinen et al. (2012) found distinct evaluations of different measures. We therefore suggest that the overall acceptance of an animal welfare program is based on the evaluation of the single measures included in the program. In line with Ajzen and Fishbein (2005), we generally hypothesize that

H1: The more positive the attitudes towards the individual measures, the stronger the subjective norm to implement each individual measure, and the higher the perceived behavioral control to do so, the stronger will be a farmer's intention to participate in the program.

To gain additional insights into potential drivers of participation in our specific case, a qualitative pre-study was conducted in May 2015. Semi-structured interviews with four consultants of the pig trading cooperative provided insights into farmers' reactions to the introduction of a new, chain-driven voluntary animal welfare initiative. The experts pointed at a general openness of farmers to animal welfare schemes, but that market situation and bonus payment are crucial. Further aspects included doubts about requirements contributing to animal welfare. Consultants also supported findings about farmers' fear for more severe regulations. These aspects exactly reflect the above reported literature-based dimensions. We assume that among the behavioral beliefs associated with single measures, the contribution of a measure to animal welfare, and the expectation of a measure becoming legally mandatory in the near future can be deemed salient for adoption.

In addition to the behavioral, normative and control beliefs, which allow for the identification of possible barriers to program adoption relying in specific measures, we test for the impact of various more general attitudinal dimensions as background variables (Ajzen and Fishbein 2005). This approach was also taken by Kauppinen et al. (2012).

H2: The more positive the attitudes towards farm animal welfare the higher the propensity to participate in an animal welfare program.

Further, we control for farmers' characteristics, including education and age, farm characteristics, such as herd size, location of the farm within or outside a village, presence of a successor, and animal husbandry conditions with special focus on already implemented animal welfare treatments.

H3: The higher the number of matching already implemented animal welfare measures on the farm,

a) the more positive the attitudes and the higher the perceived behavioral control and
b) the more likely farmers are willing to participate.

H4: Farm (e.g., location, size) and the farmer's characteristics (e.g., age, being a successor) affects the willingness-to-participate in an animal welfare program.

The drivers to implement animal welfare measure 1 to 8 combine the effects of the single TPB measures, namely attitude toward behavior, subjective norm and behavioral control, of animal welfare measure 1 to 8. This approach to use the TPB estimates is different to the classical multiplicative aggregation procedure, but nevertheless is theoretically and empirically sound (see chapter 4.3 for further explanation).

3 Material & Methods

We test our above highlighted hypotheses by means of a standardized online survey. The items for animal welfare attitudes are to the majority taken from the literature. The whole questionnaire was again pre-tested to check for potential problems of understanding. 7-point-Likert-type scales are used throughout the questionnaire.

3.1 Proposed animal welfare scheme

The eight animal welfare measures proposed in our fictioues scheme are also part of other conventional animal welfare initiatives or organic rearing regulations (see e.g. Heise et al. 2014 for a comparative list of animal welfare measures) and were selected mutually by research and practice partners in the project which underlies this study. For this analysis, all the following measures will be mandatory, when participating in our fictive animal welfare program: Increased space (10%), organic playing material, roughage, air cooling systems, functional areas, partially closed floor, no castration and no tail docking. Already existing animal welfare measures have been stated by binary 2-point-scales for each animal welfare treatment, and then have been aggregated to the sum of already existing measures. Farm and farmers' characteristics are requested as usual. Some of the farmers take part in a quality

program which is featured by a retail chain. Since we believe, that farmers who produce for a specific agent, following specific rearing and quality regulations, have process experience that lower the barriers to participate in an animal welfare program, we used a dummy variable for program participation to account for that.

3.2 Measurement of drivers to participate and willingness-to-participate

The questionnaire was developed based on the above explained framework of Theory of Planned Behavior (TPB). However, for reasons of space and survey duration, and to avoid problems as those described by French and Hankins (2003) with the notion of 'expectancy-value muddle', we deviate from the indirect measurement and the respective aggregation. Instead, we use a different approach of aggregating farmers' behavioral, normative and control beliefs, namely PCA (see chapter 4.3).

To measure the TPB beliefs we used 7-point-Likert-type scales and semantic differentials. The overall attitude towards a measure had to be indicated by judging the inclusion of a measure in an animal welfare program between "very bad" (1) to "very good" (7). The expectation whether the individual measure contributes to animal welfare was scaled from "very unlikely" (1) to "very likely" (7) to capture behavioral beliefs. For subjective norms, we asked for the importance of various peer groups with respect to farmers' animal husbandry decision ("not important at all for my husbandry", 1, to "very important", 7) as well as for these groups' expectations towards the farmer to implement the individual measures ("very unlikely" (1) to "very likely" (7)). For behavioral control, the expected ease of implementing the respective measures on the farm ("very hard to implement" (1) to "very easy" (7)), and the personal expectation of the measures becoming legally binding in the next five years had to be evaluated ("very unlikely" (1) to "very likely" (7)).

The willingness-to-participate in the program was measured twice at two distinct points in the questionnaire. In a first step, we presented farmers a list of all eight animal welfare measures. Here, farmers had to state the likelihood of their subscribing to such a program (on a 7-point-Likert-type scale "very unlikely" (1) to "very likely" (7)), when all their additional cost would be covered. After this first question, the farmers had to answer the above mentioned set of TPB items for attitude toward the behavior, subjective norm and perceived behavioral control. Second, aiming at eliciting both farmers' willingness-to-participate and their need for compensation, we designed a reverse auction to create incentive compatibility (Rutström 1998). Farmers were told that only 50% of all suppliers could take part in the program, and those with the lowest bids would be accepted. Farmers had to give a "yes" or "no" to the

question whether they would be willing to participate, and if yes, had to indicate their required bonus (per kilogram slaughter weight).

To operationalize farmers' willingness-to-participate in the program in a valid way, we combined the answers to these two questions into one categorical variable with three levels. We cross-tabulated the two questions and created a new, three-level categorical variable with 1 = twice negative answer (1-3 in scenario 1 and "no" in scenario 2), 2 = undecided, if answers differed in the two scenarios or if the first scenario was answered neutral (4); and 3 = twice positive answer (5-7 in scenario 1 and "yes" in scenario 2). The three levels were then termed as which we will understand shortly as three groups of farmers: 1 = "refusing" (N=24), 2 = "undecided" (N=20), 3 = "acquiescing" (N=18).

3.3 Methodological approach

The above described transformation of the two measures of willingness-to-participate to one categorical dependent variable requires choosing appropriate methods to test our above hypotheses. We apply multinomial logistic regression (Menard 2010), which aims at explaining the probability of participants' being in one particular category of the dependent variable. We assume that farmers' actual willingness-to-participate is a continuous underlying latent variable "y^*" which is not observable. Since we cannot analyze y^* directly, we use non-linear regression to estimate the impact of the exogenous variables on the endogenous categorical variable y, whose outcomes we can observe (Long and Freese 2006). We thus seek to model the probability that the endogenous variable "stated willingness-to-participate, "y", takes the value 1, "refusing", 2, "undecided", or 3, "acquiescing". Using log-linear transformation ensures that only positive values between 0 and 1 can occur. The model is linear in its parameters (analogous to formula 1 of a binary logit model) and estimates the β coefficients and the intercept α by maximizing the log likelihood of the model (Long 1997, Powers and Xie 2000, Woolridge 2006).

$$\ln\left\{\frac{\Pr(y=1)}{1-\Pr(y=1)}\right\} = \alpha + \beta x + \delta d \qquad \text{(Formula 1)}$$

In the simplest case of a logit model, the binary logit model, helps us understand the relationships of predictors and endogenous variable more intuitively. The log-linear model estimates the impact of the explanatory variables on the probability that a specific outcome (e.g., $y = 1$) is observed. One unit change in x will cause a hundred times $\beta\%$ change in y. Equally to one unit change in the predictor variable results in a change of β in log odds. Basic assumptions of logit models are that the explanatory variables are uncorrelated with the error

term and the mean of the residuals are not zero (Long 1997). In fact, the error term in the logit model is logistically distributed. This does not affect the efficiency of the estimates since Maximum Log Likelihood will account for heteroscedasticity (Powers and Xie 2000).

Since we have more than one categorical variable that is nominal and cannot be ordered in a logical sense, we use the multinomial logit, which can be seen as simultaneously testing all comparisons using binary logits. In our case of estimating a multinomial logit model, we choose a base category, here 2, (see formula 2), which we use as our comparison group.

$$\ln \Omega_{m|2}(x) = \ln \frac{\Pr(y=m|x)}{\Pr(y=2|x)} = x\beta_{m|2} \text{ for } m = 1 \text{ to } J \qquad \text{(Formula 2)}$$

Since we are interested in coefficients that determine participating or non-participating in an animal welfare program for pigs, respectively, we can use the multinomial logit model to make conclusions about determinants that distinct those two group of farmers to "undecided"(y = 2) farmers. The interpretation of the estimates for "acquiescing" is then as follows: an unstandardized coefficient with positive sign indicates that a one-unit increase in the predictor variable is associated with a β increase in the relative log odds of being acquiescent vs. undecided.

This research model enables us to identify the specific impacts of the TPB dimensions on the likelihood of participation or rejection versus being undecided. Namely we will investigate whether some specific requirements represent exceptional stronger barriers of participation. This would hint at potential needs of adaptations of the program or a need for more training and education for farmers to enable them to develop a more positive view of the requirements.

4 Results

139 farmers were contacted via telephone first, and 95 agreed to take part in the survey. From this group, 62 fully completed questionnaires were obtained, which build the basis for the following analysis. Given the small sample size, we analyze potential drivers of participation using post hoc tests first. Then, we present the results of the multinomial logistic regressions to explain farmers' belonging to one of the above mentioned groups and include TPB, general animal welfare attitudes, and farm characteristics as explanatory variables according to our hypotheses.

4.1 Sample description

The sample comprises 62 conventional farmers from Northern Germany. 96.8% are male respondents and age ranges from 20 to 64 years with a mean of 47 years. The majority of the

farmers are owner-managers (90.3%). The rest of the sample consists of farm successors (8.1%) and non-family farm employees (1.6%), who also stated to have significant impact on future farm development. 62.9% are specialized in pig fattening only, and 95.2% are full-time farmers. On average, the farmers operate 133.9 ha of arable land and 10.3 ha of grass land. On average, 1,976.0 pigs and 186.2 sows are kept. The farms included in this sample are thus far above the German average farm sizes.[1] The higher sample average is due to the population being specialized pig farmers from Northern Germany mainly, the sample promises interesting first gasps of answers to the question which components potentially play crucial roles for willingness-to-participate.

The stated participation rates differ between the two scenarios. In the first scenario, 21.0% would rather likely (5 or 6) or 11.29% even very likely (7) participate in the program at full compensation of incurred cost. The second scenario resulted in 53.2% of the respondents being willing to participate, if their individually demanded bonus payment is payed. Overall, bonuses demanded by those who stated to participate, fit the range of other animal welfare programs (15 to 20 EURct per kg slaughter weight (dlz 2013)). Comparing the results from the two measurements, we find an increase in the number of farmers willing to participate from the first to the second scenario. The combined analysis of the questions yielded 43.6% farmers rejecting to participate in both scenarios, while 27.4% were undecided and 29.3% willing to participate.

4.2 Explanatory variables and group comparisons

The eight requirements of the animal welfare program were evaluated heterogeneously, as reflected by the high standard deviations reported in table 1. The requirements are ordered with descending overall evaluation (attitude last column), which mostly also reflects the order in the other evaluation dimensions. Minimum and maximum values are 1 and 7, respectively for all items. The last row of table 1 also reveals that the farmers who answered negatively and those who answered positively to both scenarios differ significantly with respect to the unweighted mean of evaluations across all requirements.[2] The variance of answers is significantly reduced through the distinction of the three groups, too. Farmers who stated to be willing to participate evaluated the requirements more positively in all dimensions. This is, however, not to say that these farmers would accept to implement all requirements.

[1] The German average in 2010 is 39.3 ha arable land and 16.7 ha grass land per farm holding (Eurostat 2012).
[2] We also analyzed the differences between the accepters and non-accepters just for scenario 2, and find the significance of difference to be weaker, though still at 5%-level.

Table 1: Evaluation of individual requirements

Requirement	AW contribution[1]	Soon legally binding[1]	Subjective norm[1]	Perc. behav. control[2]	Overall attitude[3]
Increased space (10%)	5.69 ; 6.00 (1.785)	5.78 ; 6.00 (1.505)	4.80 ; 5.00 (2.108)	6.05 ; 7.00 (1.736)	5.45 ; 6.00 (1.846)
Organic playing material	4.49 ; 5.00 (1.706)	5.40 ; 6.00 (1.618)	4.17 ; 4.00 (1.949)	5.63 ; 6.00 (1.587)	4.77 ; 5.00 (1.951)
Roughage	4.63 ; 5.00 (1.737)	4.60 ; 5.00 (1.675)	3.71 ; 4.00 (2.006)	4.00 ; 4.00 (2.179)	3.75 ; 4.00 (2.172)
Air cooling systems	4.15 ; 4.00 (1.970)	3.52 ; 3.00 (1.769)	3.43 ; 3.00 (2.015)	3.26 ; 3.00 (1.986)	3.22 ; 3.00 (1.781)
Functional areas	3.32 ; 3.00 (1.812)	3.23 ; 3.00 (1.656)	2.92 ; 3.00 (1.661)	2.77 ; 2.00 (1.861)	2.78 ; 2.00 (1.663)
Partially closed floor	2.17 ; 2.00 (1.616)	3.42 ; 3.00 (1.810)	2.77 ; 2.00 (2.037)	3.15 ; 2.00 (2.252)	2.55 ; 2.00 (1.985)
No castration	1.91 ; 1.00 (1.518)	3.55 ; 4.00 (2.114)	2.08 ; 1.00 (1.661)	3.28 ; 2.00 (2.382)	2.23 ; 1.00 (1.792)
No tail docking	1.46 ; 1.00 (1.047)	4.62 ; 5.00 (2.067)	2.55 ; 2.00 (1.969)	2.89 ; 2.00 (2.333)	1.68 ; 1.00 (1.501)
Overall Mean (standard deviation)	n = 3.10^{p} (.93) u = 3.61 (.89) p = 3.85^{n} (1.01)	n = 4.14 (1.03) u = 4.25 (1.21) p =4.47 (.79)	n = 2.64^{p} (1.01) u = 3.35 (1.25) p =4.17^{n} (1.30)	n = 3.17^{up} (.94) u = 3.95^{np} (.96) p =4.78^{nu} (1.08)	n = 2.67^{up} (.77) u = 3.43^{np} (.96) p =4.05^{nu} (1.09)

Note:[1] Scale from 1 = very unlikely to 7 = very likely; [2] Scale from 1 = very difficult to 7 = very easy; [3] Scale from 1 = very bad to 7 = very good;

Upper values: Mean; Median; values in brackets: standard deviation;

Bottom row: Overall means across all requirements, compared using posthoc tests (Tamhane and Bonferroni) assuming homogeneity of variances (Levene-test non-significant); participant classes: n = "both scenarios negative", u = "undecided", p = "both positive"; indexed values indicate significant differences between groups

Source: Authors' calculations

Further comparisons between the participation classes revealed no significant differences in means and medians with respect to farm size (acreage and number of pigs), economic satisfaction, or price satisfaction.

4.3 PCA of animal welfare attitudes and TPB concepts

Before we analyze the impact of the determinants of farmers' willingness-to-participate in our fictive animal welfare program, we reduce the number of explanatory variables by means of Principal Component Analysis (PCA, see Hair et al. 2010) with STATA14.

Starting from the original items, we followed Kaiser-Meyer-Olkin with a cutoff criteria of 0.5 for the suitability of the set of items, and used elbow criterion and eigenvalue criteria with a cutoff of 1 for the appropriate number of components to describe our attitudes. After orthogonal varimax rotation we checked for factor loadings and requested loadings higher than 0.3 as cutoff criteria. Repeating this procedure, for several times, always eliminating the item with the weakest or most vague loadings that does not hold our criteria, we ended up with three animal welfare components, which best describes the latent structure of the farmers' animal welfare attitudes. The components, namely "awa_farmers as victims", "awa_responsible farming", "awa_no need to change", have been generated by estimating the

loading of the items on the component and then have been aggregated creating new variables containing the predicted loadings (see table A1 in Appendix).

The TPB proxies were subjected to PCAs for each animal welfare measure separately, following the same criteria as described above (see A2 in Appendix). The resulting TPB component can be interpreted as the driver to implement the single animal welfare measure on the farm. Thus, we have proxies of the intention to implement the single animal welfare measure on the farm. We assume that the higher the driver, meaning the more positive the farmer evaluates the animal welfare measure considering the TPB questions, the more likely the farmer will participate in the animal welfare program.

4.4 Multinomial logit findings

We started from a full model that captured all determinants derived from the literature and our new approach to explain willingness-to-participate. Step-wise, we refined the model and edited the analysis by the following procedure. We used multicollinearity tests (namely VIF criteria) and collinearities to detect coefficients that might reduce explanatory power of the model. Another crucial aspect is to whether the groups of non-participating, undecided and willing-to-participate are significantly different from one another, or if the explanatory power can be improved by reducing the dependent variable to two outcomes. Using goodness of fit estimates for multinomial logit models (following Cameron and Trivedi 2010, Long and Freese 2006), we further ran Wald tests and used AIC („Akaike's information criterion"), BIC („Schwarz's Bayesian information criterion") and pseudo R^2, here McFadden R^2, as goodness of fit criteria.

Due to high correlations of above 0.5, between the single drivers to implement animal welfare measures, we tested whether "driver_roughage" or "driver_organic playing material" is more suitable as explanatory variable, leading to the dropping of "driver_organic playing material". In addition, we observed high correlations between the TPB components and the number of already existing animal welfare measures on the farm. Since the main focus is to use TPB to explain program participation, we dropped the number of already existing animal welfare measures on the farm as explanatory variables. Furthermore, the dummy variable for slatted floor ("dum_slatted floor") was excluded in the final model. If we compare the goodness of fit measures and criteria of the full and the final model, we find that the final model is preferred over the full model with, e.g., an improved BIC of 195.390 compared to 209.265 and a higher adjusted pseudo R^2 of 0.078 compared to 0.069.

Table 2 displays the results of the final multinomial logit model. As base outcome we chose the "undecided" farmers ($y = 2$). Thus, table 2 shows on the left hand-side the estimates for "refusing" farmers ($y = 1$), and on the right hand-side the estimates for "acquiescing" farmers ($y = 3$), each contrasted with the "undecided" (y = 2).

Table 2: Multinomial logit model to explain farmers' willingness-to-participate

Willingness-to-participate	**Coef.**	**p-value**	**[95% CI]**		**Coef.**	**p-value**	**[95% CI]**	
	1 = refusing vs. 2= undecided				**3 = acquiescing vs. 2 = undecided**			
driver_space	0.93	0.156	-0.36	2.23	-1.53	0.117	-3.45	0.38
driver_roughage	-1.14	0.124	-2.59	0.31	1.81	0.062	-0.09	3.72
driver_floor	0.04	0.945	-1.23	1.32	-0.25	0.659	-1.37	0.87
driver_areas	-1.05	0.171	-2.56	0.45	-0.34	0.572	-1.53	0.85
driver_air	0.12	0.795	-0.79	1.03	-0.74	0.180	-1.82	0.34
driver_notail	-1.76	0.086	-3.76	0.25	1.14	0.167	-0.48	2.76
driver_nocastrate	-0.07	0.849	-0.81	0.67	-0.50	0.539	-2.07	1.08
awa_farmers as victims	0.44	0.637	-1.39	2.28	-2.01	0.023	-3.74	-0.28
awa_responsible farming	-0.78	0.098	-1.71	0.14	0.60	0.451	-0.96	2.15
awa_no need to change	-0.53	0.461	-1.93	0.88	1.02	0.227	-0.64	2.68
herd size	0.00	0.067	0.00	0.00	0.00	0.049	0.00	0.00
dum_quality program	1.49	0.372	-1.78	4.76	2.80	0.119	-0.72	6.32
dum_central location	-2.53	0.319	-7.51	2.45	-0.18	0.923	-3.75	3.39
age	0.18	0.029	0.02	0.34	0.15	0.198	-0.08	0.38
dum_academic	2.21	0.203	-1.19	5.60	0.08	0.959	-3.13	3.30
dum_successor	-11.77	0.996	-4680.76	4657.22	5.83	0.094	-1.00	12.65
_cons	-9.25	0.038	-17.98	-0.52	-13.85	0.067	-28.67	0.96

Note: McFadden's R^2: 0.561, AIC: 127.456, BIC: 199.78, Prob>LR: 0.000; Coef.=beta-Coefficient, CI=Confidence interval

Source: Authors' calculations

First, we focus on the determinants of being in the "refusing" as compared to the "undecided" group (see left hand side of table 2). Looking at the drivers to implement an animal welfare measure on the farm, more space, feeding roughage, and to renounce on tail docking have a significant effect on the propensity to not participate in the pig welfare program at the 10% level. Dividing the stable into functional areas has a p-value of below 0.2. Surprisingly, the higher the driver to increase space per pig, the higher the propensity to not participate in the animal welfare program. On the other hand, the more positive a farmer is towards feeding roughage, the less likely farmers will be in the group of non-participants relative to being undecided. Or, if the driver for roughage is increased by one unit, the multinomial log-odds for refusing to participate relative to being undecided would be expected to decrease.

This also holds for renouncing on tail docking. For functional areas, the coefficient is not significant at required levels, but given the small sample size could be assumed to be

meaningful. The second component of farmers' animal welfare attitudes, namely farming responsibly for animal welfare ("awa_responsible farming") has explanatory power. Thus, farmers who have stated on average higher level of agreement with items such as "Animal welfare is the most important aspect of my work" (see table A1 in Appendix) are more likely to not participate in the program than their colleagues in our sample. Herd size has stronger statistical power to explain willingness-to-participate. Farm location inside the community, negatively affect the likelihood of farmers refusing to participate as compared to being undecided. However, this effect is not significant. A farmers' age, c.p. positively affects the probability of a farmer refusing relative to being undecided.

The drivers to implement increased space and to feed roughage also significantly affect the probability of acquiescing, but with inverted signs as compared to the model for refusing. The higher the intention to feed roughage to the pigs, the more likely farmers will be willing to participate. Air cooling systems also have a coefficient at a p-value below 0.2. Considering to the animal welfare attitudes, only "awa_farmers as victims" significantly affects the probability of being in the group of acquiescing rather than undecided farmers. The herd size significantly and positively affects the belonging to the group of acquiescing at a significance level of 5%. The dummy variable "dum_successor" also significantly increases the log-odds, at a significance level of 10%. The dummy variable for quality program participation ("dum_program") and "age" show no change in the sign as compared to the multinomial log-odds for "refusing" versus "undecided".

5 Discussion

The descriptive statistics reveal a strong heterogeneity of farmers' attitudes towards the required animal welfare measures – not only across measures, but also the evaluations of the various measures differ among farmers. Air cooling systems, functional areas, partially closed (non-slatted) floor, renouncement on castration and tail docking are evaluated on average much worse than increased space (10%), organic playing material, and roughage, on all dimensions of the TPB framework, but particularly on subjective norm and the PBC dimension. This latter result is straightforward, given the longer termed commitments implied in the first mentioned criteria.

A first assessment of hypothesis 1 is given by the posthoc tests to compare three groups of farmers which differ in their propensity to participate in the program. Those willing to participate in the program exhibited much better evaluations as well as higher PBC and subjective norms across all measures as compared to those who refuse to participate. Ease of

implementation (PBC) and overall attitude towards the measures seem to be decisive for the distinction between the undecided and the acquiescing groups, respectively. The above results have to be interpreted cautiously given the small sample size. However, the significant differences between the "refusing" and "acquiescing" groups even in this small sample indicate a stable result.

We also infer from our results that the twofold measure of willingness-to-participate generates more reliable estimators: taking only the answers to the reverse auction scenario as grouping variable, yields less significant differences between the groups. The changes from scenario 1 to 2, have to be explored in more detail. They may be affected not only by the different elicitation method, but also by the TPB items which were placed between the two treatments and can be interpreted as a treatment themselves. In a replication, with a larger sample, these treatments have to be experimentally modified to distinguish the effects.

The descriptive statistics showed clear level effects of group membership for all TPB dimensions, with the acquiescing farmers always answering more positively than the refusing (except for "soon legally binding"). However, even the group of acquiescing farmers evaluates some measures rather negatively. We therefore test, by means of multinomial logit regression, whether evaluations of a measure across all TPB dimensions can be used as a predictor of farmers' belonging to the group "refusing", "undecided", or "acquiescing", respectively. With the multinomial logit model, we go beyond the above bivariate analysis to find hints for determinants of program participation. We found confirmation that we have three distinct groups using the likelihood ratio test criteria for linear combination.

Our findings underline the difficulty of shaping animal welfare programs such that a sufficient number of farmers participate. While farm and farmer characteristics such as herd size, or age, cannot be altered by supply chain actors, the results reveal some potential to influence farmers' beliefs through extension and communication: expected ease of implementation, but also doubts about the contribution to animal welfare, or upcoming regulations play a crucial role, namely for measures which require long term commitments. Farmers who have already implemented some of the measures or who have earlier experience in participating in retailer-driven quality programs have a stronger tendency to participate. These farmers could be used as multipliers in communicating the program: as peers, they might be more credible than advisers who are paid by other chain actors. This, however, has to be verified in future studies. An important finding with respect to the group of acquiescing farmers is that these farmers exhibit a tendency to be more proactive, while the undecided feel more like being

victims of societal pressure. Assuming an s-shaped adoption curve (Rogers 2003) for participation in the animal welfare program, the undecided could be understood as followers, who need to see proof for the functioning of the program before participating themselves. To increase the probability of success for the animal welfare program, efforts should first be made to include farmers with a relatively great herd size, farmers that already have experience producing for a quality program, and successors. Based on the experiences of these "pioneer" farmers, further arguments can be generated to attract farmers from the "undecided" group.

A potential limitation of this study is the large number of predictor variables compared to the number of observations. The significant effects of farm and farmer's characteristics on the willingness-to-participate, however, can be interpreted as a hint. Additionally, we had to account for the fact that some farmers already had experience producing for a quality pork program, since those farmers already have experience in such producer program collaborations.

6 Conclusion

The aim of this study was to analyze determinants which drive or limit farmers' willingness-to-participate in an animal welfare program for pigs. The findings are not representative for German pig farmers, due to our focus on a Northern German cooperative. The small sample size, which, however, represents about one half of the cooperative's members, prohibits some more detailed analyzes. Nevertheless, we find important hints as to the heterogeneity of farmers' beliefs surrounding different animal welfare measures and can derive some preliminary conclusions how to gain farmers' support for an animal welfare program. Setting the requirements mandatory facilitates communication of such a program to consumers, but poses important barriers for farmers, especially if long term commitments are required. Besides the beliefs concerning particular measures, farmers' perception of their own role, namely their responsibility for animal welfare and the perception of being a victim of societal pressures, are important issues which need to be adressed through extension and communication.

Future research is needed to refine the measures of willingness-to-participate and to understand which arguments to convince farmers of the usefulness of participation. This goes beyond increasing the number of participants in the survey and also includes variations in the experimental set up of the study.

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Appendix

Table A1: Descriptive statistics and factor loadings of animal welfare attitudes

Animal welfare attitude items	Mean	Median	Std. Dev.	Components 1	2	3
As a farmer I have no choice but to produce cheaply.	5.21	6.00	1.95	0.588	-0.035	-0.063
We farmers are always the fools and remain sitting on the costs.	5.74	6.00	1.62	0.552	0.049	0.073
As a livestock owner, I feel severely criticized by society.	5.31	6.00	1.65	0.469	0.046	0.085
Good hygiene is the prerequisite that the animals feel well.	5.79	6.00	1.38	0.126	0.560	-0.190
Animal welfare is the most important aspect of my work.	4.87	5.00	1.72	0.068	0.544	-0.018
An animal must be able to perform its' innate behavior.	4.63	5.00	1.39	-0.195	0.535	0.097
It is my job as a farmer to do more for animal wellbeing in the stables.	5.16	5.00	1.53	-0.212	0.209	0.513
Our laws and legal provisions for animal husbandry are entirely sufficient.	5.76	6.00	1.48	0.154	0.154	0.448

Note: Component 1 = "awa_farmers as victims", 2 =" awa_responsible farming", 3 = "awa_no need to change"
Source: Authors' calculations

Table A2: Descriptive statistics and factor loadings of TPB components

TPB items	Mean	Median	Std. Dev.	Factor loadings
Increased space (10%)				**driver_space**
AW contribution	5.73	6.00	1.81	0.485
Subjective norm	4.79	5.00	2.16	0.469
Perc. behav. Control	6.06	7.00	1.73	0.422
Overall attitude	5.52	6.00	1.85	0.523
Soon legally binding	5.82	6.00	1.52	0.305
Roughage				**driver_roughage**
AW contribution	4.48	5.00	1.74	0.434
Subjective norm	4.23	4.00	1.95	0.470
Perc. behav. Control	5.60	4.00	1.61	0.468
Overall attitude	4.77	4.00	1.99	0.513
Soon legally binding	5.35	5.00	1.64	0.330
Organic playing material				**driver_organic material**
AW contribution	4.58	4.50	1.75	0.466
Subjective norm	3.73	4.00	2.02	0.453
Perc. behav. Control	4.02	6.00	2.17	0.416
Overall attitude	3.76	5.00	2.21	0.510
Soon legally binding	4.60	6.00	1.69	0.381
Partially closed floor				**driver_floor**
AW contribution	2.19	2.00	1.64	0.490
Subjective norm	2.74	2.00	2.03	0.470
Perc. behav. Control	3.13	2.00	2.26	0.469
Overall attitude	2.55	2.00	1.96	0.540
Soon legally binding	3.42	3.50	1.83	0.166
Functional areas				**driver_areas**
AW contribution	3.32	3.00	1.85	0.463
Subjective norm	2.97	3.00	1.66	0.491
Perc. behav. Control	2.76	2.00	1.88	0.491
Overall attitude	2.76	2.00	1.68	0.496
Soon legally binding	3.18	3.00	1.66	0.242
Air cooling systems				**driver_air**
AW contribution	4.15	4.00	1.97	0.473
Subjective norm	3.44	3.00	2.01	0.517
Perc. behav. Control	3.31	3.00	2.00	0.336
Overall attitude	3.23	3.00	1.81	0.522
Soon legally binding	3.55	3.00	1.81	0.351
No tail docking				**driver_notail**
AW contribution	1.47	1.00	1.07	0.480
Subjective norm	2.50	1.50	1.95	0.485
Perc. behav. Control	2.97	2.00	2.36	0.441
Overall attitude	1.71	1.00	1.53	0.521
Soon legally binding	4.69	5.00	2.06	0.262
No castration				**driver_nocastrate**
AW contribution	1.87	1.00	1.50	0.434
Subjective norm	2.08	1.00	1.67	0.389
Perc. behav. Control	3.24	2.00	2.37	0.484
Overall attitude	2.24	1.00	1.81	0.534
Soon legally binding	3.65	4.00	2.12	0.375

Source: Authors‘ calculations

References

Ajzen, I. 1991. Theories of Cognitive Self-Regulation. The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes* 50(2): 179-211.

Ajzen, I. and M. Fishbein. 2014. The Influence of Attitudes on Behavior. In *The Handbook of Attitudes*, edited by Albarracín, D., Johnson, B.T. and M. P. Zanna, 173-221. Psychology Press, New York.

Bock, B.B. and M.M. van Huik. 2007. Animal welfare: the attitudes and behaviour of European pig farmers. *British Food Journal* 109(11): 931-944.

Boehm, J., Kayser, M. and A. Spiller. 2010. Two sides of the same coin? Analysis of the web-based social media with regard to the image of the agri-food sector in Germany. *International Journal on Food System Dynamics* 1(3): 264-278.

Botreau, R., Veissier, I. and P. Perny. 2009. Overall assessment of animal welfare: strategy adopted in Welfare Quality®. *Animal Welfare* 18(4): 363-370.

Bruijnis, M., Hogeveen, H., Garforth, C. and E. Stassen. 2013. Dairy farmers' attitudes and intentions towards improving dairy cow foot health. *Livestock Science* 155(1): 103-113.

Cameron, A.C. and P.K. Trivedi. 2010. *Microeconometrics using Stata*. Stata Press, Texas.

Deimel, I., Franz, A. and A. Spiller. 2012. Animal welfare: An Empirical Analysis of Agricultural Frames. *German Journal of Agricultural Economics* 61(2): 114-126.

dlz. 2013. Mästen für das Tierschutzlabel. dlz agrarmagazin. http://www.agrarheute.com/dlz/news/maesten-fuer-tierschutzlabel [accessed November 5, 2015].

Dwane, A.M., More, S.J., Blake, M., McKenzie, K. and A.J. Hanlon. 2013. Farmers' self-reported perceptions and behavioural impacts of a welfare scheme for suckler beef cattle in Ireland. *Irish Veterinary Journal* 66(1): 1-11.

Escobar, M. and H. Buller. 2014. Projecting Social Science into Defra's Animal welfare Evidence Base: A review of current research and evidence base on the issue of farmer behaviour: A report to the Department for Environment. Department for Environment, Farming, and Rural Affairs, London.

Eurostat. 2012. Eurostat Statistics Explained. Agricultural census in Germany. http://ec.europa.eu/eurostat/statistics-explained/index.php/Agricultural_census_in_Germany [accessed March 9, 2018].

Franz, A., Deimel, I. and A. Spiller. 2012. Concerns about animal welfare: a cluster analysis of German pig farmers. *British Food Journal* 114(10): 1445-1462.

French, D.P. and M. Hankins. 2003. The expectancy-value muddle in the theory of planned behaviour - and some proposed solutions. *British Journal of Health Psychology* 8(1): 37-55.

Hair, J.F., Black, W.C., Babin, B.J., Anderson, R.E. and R.L. Tatham. 2010. *Multivariate data analysis.* Pearson, Upper Saddle River [et al.].

Hansson, H. and C.J. Lagerkvist. 2015. Identifying use and non-use values of animal welfare: Evidence from Swedish dairy agriculture. *Food Policy* 50: 35-42.

Heise, H., Pirsich, W. and L. Theuvsen. 2014. Improved process quality through certification systems: an assessment of selected animal welfare labels. *Proceedings in Food System Dynamics* 2014:1-11.

Hubbard, C., Bourlakis, M. and G. Garrod. 2007. Pig in the middle: farmers and the delivery of farm animal welfare standards. *British Food Journal* 109(11): 919-930.

Kauppinen, T., Vesala, K.M. and A. Valros. 2012. Farmer attitude toward improvement of animal welfare is correlated with piglet production parameters. *Livestock Science* 143(2-3): 142-150.

Kirchner, M.K., Westerath-Niklaus, H.S., Knierim, U., Tessitore, E., Cozzi, G., Vogl, C. und C. Winckler. 2014. Attitudes and expectations of beef farmers in Austria, Germany and Italy towards the Welfare Quality (R) assessment system. *Livestock Science* 160: 102-112.

Long, J.S. 1997. *Regression Models for Categorical and Limited Dependent Variables*. Sage Publications, Thousand Oaks.

Long, J.S. and J. Freese. 2006. *Regression Models for Categorical Dependent Variables Using Stata*. Stata Press, Texas.

Menard, S. 2010. *Logistic regression: From introductory to advanced concepts and applications*. Thousand Oaks, CA: Sage.

Powers, D.A. and Y. Xie. 2000. *Statistical methods for categorical data analysis.* Academic Press, San Diego.

Rogers, E.M. 2003. *The Diffusion of Innovations*. The Free Press, New York.

Rutström, E.E. 1998. Home-grown values and incentive compatible auction design. *International Journal of Game Theory* 27(3): 427-441.

Shaw, D., Shiu, E. and I. Clarke. 2000. The contribution of ethical obligation and self-identity to the theory of planned behaviour: An exploration of ethical consumers. *Journal of Marketing Management* 16(8): 879-894.

Sparks, P., Guthrie, C.A. and R. Shepherd. 1997. The Dimensional Structure of the Perceived Behavioral Control Construct. *Journal of Applied Social Psychology* 27(5): 418-438.

Spooner, J.M., Schuppli, C.A. and D. Fraser. 2014. Attitudes of Canadian Pig Producers Toward Animal Welfare. *Journal of Agricultural and Environmental Ethics* 27(4): 569-589.

Te Velde, H., Aarts, N. and C. Van Woerkum. 2002. Dealing with ambivalence: farmers' and consumers' perceptions of animal welfare in livestock breeding. *Journal of Agricultural and Environmental Ethics* 15(2): 203-219.

Vanhonacker, F., Verbeke, W., Van Poucke, E., Buijs, S. and F.A.M. Tuyttens. 2009. Societal concern related to stocking density, pen size and group size in farm animal production. *Livestock Science* 123(1): 16-22.

Scientific Advisory Board on Agricultural Policy (WBA). 2015. Pathways to a socially accepted livestock husbandry in Germany. Executive Summary and Synthesis Report. Berlin.

Wooldridge, J.M. 2006. *Introductory econometrics. A modern approach.* Thomson/South-Western, Mason [et al.].