Assessing farmers' preferences for the future of the Common Agricultural Policy: insights from of a discrete choice experiment in Germany

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Abstract

This paper analyses the determinants of German farmers' acceptance of alternative agricultural policy packages. The analysis is based on a discrete choice experiment with 434 farmers from across Germany. The study participants presented with the choice of three different policy packages in each of the seven choice sets for which responses were to be given, plus an option to withdraw from the present agricultural policy. The data was analysed using a random parameter logit model and a latent class estimation to reveal preference heterogeneity among those surveyed. Around two thirds of respondents declared themselves to be in favour of the continuation of direct payments. Less than half of the respondents (40 %) were prepared in principle to accept higher standards in the environment and animal welfare in return for continued direct payments. However, nearly one quarter (23%) of those surveyed wanted direct payments to continue without having to do anything in return. The majority of farmers surveyed were against a state safety net through market intervention. One third of respondents wanted the abolition of the Common Agricultural Policy in its present form, including direct payments.

Keywords

Common agricultural policy, discrete choice experiment, analysis of acceptance

1. Introduction

Viewing the Common Agricultural Policy (CAP) from a historical perspective, it is clear that its objectives and instruments have adapted to the needs of the respective time. In the early days the CAP was about supplying the population with food in sufficient quantities at affordable prices. Assistance was also to be given to farmers: they were to become more productive and able to share in general income trends. To achieve these goals an agricultural policy was created that linked support for farmers directly to production: the price support policy offered strong incentives for greater production and higher productivity. When the downside of this policy became evident for the first time in the late 1970s, attempts were made to counteract it with production quotas and co-responsibility levies. The first serious reform in 1992 reduced intervention prices and compensated farmers with area-based compensatory payments. However it took until 2005 for these payments to largely be decoupled from production. The cross-compliance rules indirectly coupled the area-based payments with a good that has in the meantime became scarce in society: the rural environment. With the introduction and strengthening of the second pillar in subsequent reforms and the implementation of greening requirements on 1.1.2015, the re-coupling of payments to socially desirable environmental goods and services was once again reinforced.

In the current debate on agricultural policy, calls are increasingly being made to link available funds even more closely to the delivery of public goods in the countryside. These demands range from a clear strengthening of the second pillar all the way to abolishing the pillar structure and transferring to a Common Agricultural Policy architecture that directly targets substantive problems in the sector (WBA, 2010; ISERMEYER, 2016). The original objectives of the CAP –

security of supply and equal income – play an increasingly small role in this. The primary focus is on demands for stabilisation and risk management programmes as a new element of the CAP, as well as a greater inclusion of agriculture in climate protection policy.

This paper aims to assess farmers' preferences concerning the future development of the CAP. What would farmers like to see from the CAP after 2020? Time and again it is clear that farmers, like other citizens, are dissatisfied with the current CAP: farmers criticise the excessive bureaucracy and restriction of entrepreneurial freedom through greater regulation and intensity of inspections. In addition to a distribution of subsidies that is deemed to be unfair, members of the public denounce many facets of modern agriculture, in particular animal husbandry, created by the existing agricultural policy. To date there have been no studies that have systematically investigated the preferences of addressees (farmers). The objective of this paper is to contribute to the debate on CAP reform by identifying the factors that determine its acceptance and thus offers suggestions as to what a socio-politically more sustainable CAP might look like after 2020. With its focus on socio-political acceptance, this paper differs from numerous scientific studies that have focused on the effectiveness and efficiency of the CAP in achieving its objectives.

2. Methodology and data

2.1 Discrete choice experiments: Methodological principles

The empirical analysis is based on a discrete choice experiment with 434 German farmers. In a discrete choice experiment (DCE) the respondents are given a choice of various alternatives (here policy bundles), each identified through a series of attributes (here direct payments, animal welfare standards, ecological focus area (EFA), permissible nitrogen balance surpluses and market safety net). Survey participants were then asked to select their preferred policy bundle. It was assumed that a respondent *j* selects the alternative that gives him or her the greatest utility *U* out of all possible alternatives *K*. The alternatives in the present study were three different policy bundles and the option of discontinuing the CAP while maintaining statutory minimum standards in the area of animal welfare and fertiliser application. The utility *U* can statistically be split into a deterministic part *V* and a stochastic part ε. The latter indicates unobserved variables and measurement errors. The deterministic utility is a linear additive function of attributes z_k of the selected policy option *k* and the personal characteristics s_j of the respondent *j* (BEN-AKIVA AND LERMAN, 1994):

$$U_{jk} = V(z_{jk}, s_j) + \varepsilon_{jk} = \alpha\, z_{jk} + \gamma\, s_j + \varepsilon_{jk} = \beta x_{jk} + \varepsilon_{jk} \qquad \text{where}$$

U_{jk} = utility of policy alternative *k* for respondent *j*

α = vector that gives the marginal influence of attributes z_{jk} of alternative *k* on utility

γ = vector that gives the marginal influence of personal characteristics s_j on utility

β = vector of the parameters to be estimated

x_{jk} = vector of exogenous variables z_{jk} and s_j.

Furthermore, utility cannot be observed, only the decision of which alternative was selected. Therefore the probability that respondent *j* selects an alternative $n \neq k$ from his/her choice set Ω_j is the same as the probability that these alternatives provide a greater utility than all the other

alternatives in the choice set $\Omega_j = \{k \mid k = 1, 2, ..., K\}$(BEN-AKIVA AND LERMAN, 1994). In the present study, $k = 1, 2, 3$ represent the policy alternatives offered and $k = 4$ the alternative of discontinuing the CAP. When a binary variable y is introduced for each alternative from the choice set that takes the value of 1 when respondent j selects alternative n, otherwise 0, the probability of choosing a policy alternative can be formulated as follows:

$$P_{jn} = prob(V_{jn} + \varepsilon_{jn} > V_{jk} + \varepsilon_{jk}; \forall k \in \Omega_j; n \neq k) = prob(y_n = 1) = F_n(x_{jk}, \gamma)$$ where

P_{jn} = probability that respondent j selects policy alternative n

x_{ji} = vector of the exogenous variables z_{jk} und s_j

γ = vector of the estimation parameters from which β can be calculated.

P_{jn} can be described through a probit or logit function F_n, which is normalised to the scale relevant to probabilities from 0 to 1. The logit models primarily used in the analysis of choice experiments are based on the assumption of a logistically distributed error term (GREENE, 2012: 686-690). An overview of the models generally used in discrete choice analysis with binary regressands is given in GREENE (2012: 681-773). The econometric evaluation methods are based on the work of MCFADDEN (1974) and LOUVIERE AND WOODWORTH (1984). We used a Random Parameter Logit (RPL) model that allows the unobserved factors to follow any distribution by decomposing error term into two parts: one part that contains all the correlation and heteroscedasticity and another part that is IID extreme value. In contrast to the standard logit specification, the RPL model allows the estimation parameters β to vary across respondents and thereby assumes heterogeneity in preferences for policy bundles. We further employed a Latent Class Model (LCM) to obtain segmentation into latent (that is, not observable by the analyst) groups of farmers with similar preferences for policy attributes whereby preferences between groups are heterogeneous. The membership of a class is determined by a logit function including the farmers' characteristics (Pacificio & Yoo, 2012).

2.2 Choice sets

The objective of the DCE is to evaluate respondents' preferences for alternative policy packages. The attributes used in the choice design and their characteristics are given in

Table **1**. The policy attributes were derived from the current debate on CAP reform. With the 'direct payments' attribute, no distinction was made between the basic payment and the greening premium. Rather the respondents were told that it concerned the total payment per hectare of land. With the attributes of 'animal welfare' and 'ecological focus area', the third attribute level in each case comprised a requirement for a compensation payment. The respondents were told that these cases did not involve optional programmes from the second pillar, but legally binding requirements whose economic disadvantages were balanced out by a premium for the amount specified. For the 'permissible nitrogen balance surplus' attribute, the third attribute level consisted of a statutory standard (< 50 kg N/ha) in combination with a surplus levy of € 2/kg N, with the latter imposed if a farmer exceeds the 50 kg requirement. As the variable 'market safety net' tested negatively on linearity, the characteristics could only be included in the model using effect coding (*cf.* Hensher et al. 2005). In doing so, the mean of the three attribute levels (24 ct/kg milk and € 140/t wheat) was chosen as the reference.

Table 1: Attributes and attribute levels of the DCE

Attributes	Attribute levels
1) Direct payment	€ 150 / € 200 / € 250 /ha
2) cological focus area	5 % of arable land 8 % of arable land 8 % of arable land as green set-aside with € 500/ha premium
3) Animal welfare	Legal minimum standard under the Animal Husbandry Ordinance Standards of the Animal Welfare Initiative with pigs and 6 months' grazing for cows Standards of the Animal Welfare Initiative plus € 3/pig and 6 months' grazing plus € 100/cow per year
4) Permissible nitrogen balance surplus	60 kg N/ha 50 kg N/ha 50 kg N/ha plus € 2/kg excess levy for quantities > 50 kg N/ha
5) Market safety net	22 ct/kg milk 24 ct/kg milk 26 ct/kg milk € 120/t wheat € 140/t wheat € 160/t wheat

The attribute levels were varied systematically between the choice sets so that policy packages between which respondents were to choose were in competition with one another. In choosing the most preferred policy package, farmers had to consider trade-offs between different attributes and their levels. In each choice set the farmers were offered an pot-out option, which meant a policy package without direct payments or safety net with only minimal requirements concerning the environment and animal welfare. Using SPSS software, a reduced orthogonal design with 64 choice sets was produced. The design used featured a D-efficiency value of 96 % [1]. Table 2 gives an example of a choice set. The respondents were presented with six such choice sets and asked to choose their preferred policy bundle in each.

[1] D-efficiency is a measure of the lack of correlation (orthogonality) of the attribute levels in a DCE as a prerequisite of consistent estimation results. A value of 100 % indicates that the DCE has a perfect orthogonal design. In his choice experiments SCHULZ operated with D-efficiency values of between 95.8 % and 98.1 %, but also referred to another study with a design efficiency of just 91.3 % (SCHULZ, 2013: 212). Although there is no specific statistical value of a D-efficiency value from which a design becomes unusable, values over 90 % are considered sufficient (KUHFELD, 2005).

Table 2: Examples of a choice set

Attributes	**Policy 1**	**Policy 2**	**Policy 3**	**Opt-out**
Direct payments	€ 150 /ha	€ 250 /ha	€ 150 /ha	No
Ecological focus area	5 %	5 %	8 %	No
Animal welfare	Animal Welfare Initiative + € 3/pig, 6 months pasture + € 100/cow	Animal Welfare Initiative + € 3/pig, 6 months pasture + € 100/cow	Legal minimum standards	Legal minimum standards
N excess	60 kg/ha	50 kg/ha + excess levy	60 kg/ha	60 kg/ha (=legal min. standard)
Safety net	22 ct/l milk € 120/t wheat	22 ct/l milk € 120/t wheat	24 ct/l milk € 140/t wheat	No safety net
I choose	□	□	□	□

2.3 Survey

Farmers' preferences for the design of the CAP after 2020 were identified in a nationwide (Germany) survey of farm managers. Data were collected online. Farmers were encouraged to participate in the online survey through an advertisement in the agricultural trade press in the summer of 2016. They were asked to follow a link to the online questionnaire which was administered on the authors' departmental webpage. A total of 440 farmers (with a fully completed questionnaire) took part in the online survey. Six of the surveyed farmers answered the choice sets incorrectly and therefore had to be removed from the sample. In all 434 questionnaires were available for evaluation. In addition to the choice sets, the respondents were given a debriefing questionnaire. Alongside demographic and socioeconomic data, their attitudes on current agricultural policy, animal welfare and the relationship between agriculture and the environment were also sought. The descriptive statistics of the sample are in Annex 1.

3. Results

Table 3 shows the results of the Random Parameter Logit (RPL) model. As well as estimated coefficients, it depicts the marginal effects and necessary compensation prices (WTA = willingness to accept) for changes in the respective attribute levels by one unit compared with the respective reference. The model accuracy was calculated using pseudo R^2 in accordance with MCFADDEN (1974). According to LOUVIERE ET AL. (2000) and COSTANZO ET AL. (1982) the ascertained value of 0.45 can be considered very good.

It is clear from the signs of the estimated coefficients that, on average, the surveyed farmers wanted the direct payments to continue – while simultaneously rejecting of all other policy attributes. For example, if a policy bundle requires animal welfare standards to be raised from the current legal minimum to the higher standards of the Animal Welfare Initiative or six months' grazing for cows, this would reduce the probability of that policy option being chosen by 5 % compared to the opt-out option. The necessary payment for utility-neutral compensation of thus enhanced animal welfare standards is € 82/ha. Thus the respondents would have to be offered a direct payment of € 82/ha more to restore the original choice probability of a policy option (compared to the opt-out option). The € 82/ha should be interpreted as the 'perceived cost' of increased animal welfare standards. Similarly, the requirement to manage 8 % of arable land as Ecological Focus Area leads to costs of € 70 /ha.

Table 3: Results of the mixed logit estimates

Random parameter logit N= 434; 2911 choices Likelihood: -2756.89 Pseudo R^2: 0.45					
Policy element	Variable type	Coefficient	Marginal effects	WTA	Reference
Direct payments	Continuous	0.008***			
Animal Welfare Initiative/ 6 months pasture	Dummy	-0.644***	-5.0 %	€ 82/ha	Legal minimum standard
Animal Welfare Initiative/6 months pasture with premium	Dummy	-0.389***	-1.7 %	€ 49/ha	Legal minimum standard
8 % EFA	Dummy	-0.548***	-5.0 %	€ 70 /ha	No EFA
8 % EFA as green set-aside with premium	Dummy	-0.234**	-1.9 %	€ 30/ha	No EFA
50 kg N/ha plus surplus levy	Dummy	-0.361***	-3.1 %	€ 46 /ha	60 kg N/ha
Market safety net low	22 ct/kg milk and € 120/t wheat	-1.108***	-6.0 %	€ 141 /ha	24 ct/kg milk and € 140/t wheat
Market safety net high	26 ct/kg milk and € 160 /t wheat	-0.473**	-3.2 %	€ 60/ha	24 ct/kg milk and € 140/t wheat

While the rejection of requirements in the area of biodiversity, fertilisation and animal welfare was to be expected, it should be noted that these requirements were also rejected when state compensatory payments were offered. For example, if farmers had to set-aside 8 % of their arable land as Ecological Focus Area with a green cover and were given a € 500/ha premium in return, this was still significantly rejected with perceived costs of € 30/ha. The highly significant rejection of the low and high level of a market safety net, which were input into the

estimation as effect-coded variables, is also striking. The introduction of a safety net with relatively low prices (22 ct/kg milk and € 120/t wheat) would have to involve compensation with a direct payment € 141/ha higher in order to compensate the respondents for the loss of utility. A safety net with higher prices (26 ct/kg milk and € 160/t wheat) required compensation of € 60/ha. In summary, therefore, the stance taken by respondents was to thoroughly reject state interventions, be it in the form of environmental or animal welfare requirements or interventions in agricultural markets.

The estimated coefficients for the policy attributes demonstrate substantial and highly significant standard deviations that point to a considerable heterogeneity of preferences between the surveyed farmers. Against this backdrop, in addition to the RPL model, a latent class model (LCM) was estimated. Alongside the alternative-specific variables, the LCM estimation included person-specific and farm-specific features as class membership variables. The LCM divides the sample of respondents into segments of people who show similar preferences. Preference heterogeneity predominates intersegmentally. Advantages come when there are antipodes between the segments. In such cases mixed logit models would result in the counteracting effects cancelling each other out under loss of significance (SAGEBIEL, 2011: 15). The optimal segmentation of the dataset is undertaken *ex post* by estimating several LCM of different degrees of segmentation and analysis of the resultant AKAIKE (AIC) and BAYES (BIC) information criteria. With increasing segmentation of the dataset, the model accuracy grows due to additional estimation parameters. As with the adjusted determination coefficients in linear regression models, AIC and BIC "penalise" an excessive formation of classes when there is no marked improvement in model accuracy. The use of the AIC and BIC information criteria led to an optimum segmentation into three classes in the present dataset[2]. The BEN-AKIVA and SWAIT-Test (BEN-AKIVA and SWAIT, 1986) rejects the null hypothesis whereby the more economical RPL model is preferred to the more complex LCM at the highest level of significance (p=0.00). Table 4 shows the estimation results of the LCM. It portrays for each class of respondents the estimation coefficients and the corresponding WTA estimates for the individual policy attributes.

It is clear from Table 4 that respondents in Class 1 reject state interventions in the environment and animal welfare much more strongly than the average respondent: the increase in the amount of direct payment necessary for utility-neutral compensation is much greater than that portrayed in Table 3 for the average of everyone surveyed. Class 1 respondents are indifferent to a market policy safety net, as suggested by the non-significant coefficient estimate. The respondents in this class only value highly significantly the continuation of direct payments. They wanted to have as much entrepreneurial freedom as possible while direct payments continue. They could thus be characterised as farmers who wish to protect their vested rights.

Respondents in Class 2 also value the continuation of direct payments highly significantly. They also want a market safety net with relatively high prices, but reject one with lower prices. For a safety net with high guaranteed minimum prices (26 ct/kg milk and € 160/t wheat), the

[2] The information criteria CAIC (Corrected Akaike Information Criterion) and BIC (Bayesian Information Criterion) used for optimal class determination according to BOXALL and ADAMOVICZ (2002) argue in the present case for a model with three classes as they are lower for the observed model with three classes (CAIC: 5603.632; BIC: 5551.632) than for those with, for example, two classes (CAIC: 5687.044; BIC: 5657.044).

respondents in Class 2 would be prepared to relinquish an amount of € 102/ha in direct payments. They also support increased mandatory animal welfare standards when economic disadvantages are compensated for by a premium. The only policy attribute rejected is a compulsory 8 % Ecological Focus Area without compensation. The Class 2 respondents have an indifferent attitude towards the remaining policy attributes. In contrast to the Class 1 respondents, the Class 2 respondents could be characterised as farmers who in principle would be willing to have to do something, particularly in the area of animal welfare, in return for state payments in the form of direct payments and minimum pricing. Class 2 respondents could thus be characterised as farmers who are 'ready for change'.

Table 4: Results of the LCM estimations

AIC: 5335.10 BIC: 5740.04	Class 1 23.1%		Class 2 40.4%		Class 3 36.5%	
Policy attribute	Coefficient	WTA	Coefficient	WTA	Coefficient	WTA
Direct payments	0.005***		0.009***		-0.005	
Animal Welfare Initiative/6 months pasture	-1.359***	€244/ha	0.146		-0.398	
Animal Welfare Initiative/6 months pasture with premium	-1.526***	€275/ha	0.555***	€-62/ha	-0.411	
8 % EFA	-0.574***	€103/ha	-0.246**	€28/ha	-0.643	
8% EFA as green set-aside with premium	-0.428**	€77/ha	-0.022		-0.714*	€156/ha
50 kg N/ha plus surplus levy	-0.443**	€80/ha	-0.105		-1.258**	€275/ha
Market policy safety net low	0.026		-0.342***	€38/ha	-1.418***	€310/ha
Market policy safety net high	-0.005		0.906***	-€102 /ha	-0.631**	€138/ha

The Class 3 respondents are indifferent to a continuation of direct payments and thoroughly reject state interventions in agricultural markets. They declare themselves highly significantly to be against a market safety net. Furthermore they are against stringent standards in fertilisation in conjunction with a nitrate surplus fee. Even an Ecological Focus Area in the form of green set-aside carrying a premium of € 500/ha on 8 % of arable land was significantly rejected. This underlines the particular aversion to a state "payment" of any kind. The farmers in this class therefore want an agricultural policy that offered them the greatest possible entrepreneurial freedom while at the same time rejecting any kind of state support. They consequently vote against the continuation of the present agricultural policy and want the state to withdraw as much as possible from regulating the agricultural sector. These farmers can be characterised as 'the liberalists'.

By including person-related and farm-related variables in the LCM estimations, two of the three classes of farmers could be characterised more closely. The influence of person-related and farm-related features on the probability of belonging to one of the three classes is described by the estimated coefficients of the class membership variables. The reference class is Class 3. Consequently, the coefficients show how the respective individual feature changes the probability that a respondent's preferences would be portrayed best by either Class 1 or Class 2 rather than Class 3. For reasons of space, Table 5 only offers a summary of the estimation results, without depicting the estimation coefficients in detail.[3]

Table 5: Determinants of class membership

Class 1: "Protectors of vested rights" (23.1 % of respondents)	**Class 2: "Ready for change" (40.4 % of respondents)**
+ Larger arable farms	+++ Older farmers
-- Agreed with the statement "Farming makes an important contribution to wildlife conservation"	++ Part-time farmers
+ Rejected the statement "Farmers protect animals and put animal welfare above financial success"	+++ Agreed with the statement "The state should support the current low milk price through market interventions"
+ Agreed with the statement "The state should support the current low milk price through market interventions"	+ Rejected the statement: "In future farming should no longer be subsidised by the state"
++ Farming is main occupation	++ Farming is main occupation

Key: +++ very high, ++ high-, + weakly significant positive influence on class affiliation; --- very high, -- high, weakly significant negative influence on class membership.

Farmers in Class 3, who reject a continuation of the current agricultural policy and want an extensive withdrawal of the state from regulation and subsidisation of the agricultural sector, serves as a reference class in the LCM model and therefore cannot be characterised in greater detail. Nevertheless in order to characterise this group of farmers, a multinomial logit model was also estimated in which the dataset was split into two groups of respondents: (1) those who consistently (*i.e.* in each choice set) selected the opt-out option (n =130) and (2) all the others (n = 197). The latter group comprised farmers who either always selected one of the policy options offered (therefore never withdrawal), and respondents who selectively chose policy options and the opt-out option (n= 107). The logit estimations offers the following profile of people who back the opt-out option. In comparison with those who weigh up the pros and cons, older farmers for whom farming is their main occupation and farmers without farm successors lined up have a highly significantly greater probability of falling into the group of people who back a discontinuation of the CAP in its current form. The same applies to farmers who in the past had problems complying with the Fertiliser Ordinance and those who have already participated in agri-environmental programmes. It was unsurprising that in the group of people who are more likely to back discontinuation of the CAP were farmers who in the survey said they were against the statements "The state should support the current low milk price through

[3] These can be requested from the authors if required.

market interventions" and "In future farming should no longer be subsidised by the state". Furthermore in the group who have a significantly higher probability of opposing the current agricultural policy were farmers who agreed with the statement "Farming makes an important contribution to wildlife conservation".

4. Summary and conclusions

In summary it was ascertained that around two-thirds (63.5%) of those surveyed want direct payments to continue. In return under half (40.4 %) are prepared in principle to accept higher standards in the areas of the environment and animal welfare. Twenty-three per cent of those surveyed though wanted direct payments continue without having to do anything in return. The majority of surveyed farmers were against a state safety net through market intervention. Just over one third of respondents want the abolition of the Common Agricultural Policy in its present form. This explicitly includes direct payments. The lack of acceptance of the CAP itself among farmers points to the policy no longer succeeding in communicating its utility to a section of those to whom it is addressed. Instead there is a growing call for radical change with populist appeal – a Brexit effect in agricultural policy perhaps?

References

Ben-Akiva, M. and Lerman, S. R. (1994): Discrete Choice Analysis: Theory and Application to Travel Demand. MIT Press Series in Transportation Studies, 6. Auflage, MIT Press, Cambridge. https://mitpress.mit.edu/books/discrete-choice-analysis

Boxall, P.C. and Adamovicz, W.L. (2002): Understanding heterogeneous preferences in random utility models: a latent class approach. *Environmental and Resource Economics* 23(4), 421-446.

Costanzo, C.M., Halperin, W.C., Gale, N.D. and G.D. Richardson (1982): An Alternative Modell for Assessing Goodness of Fit for Logit-Models. *Environment and Planning A*. 14(7), 936–971.

Greene, W.H. (2012): *Econometric Analysis*. 7th ed. Boston: Prentice Hall.

Hensher, D.A., Rose, J.M. and W.H. Greene (2005): *Applied Choice Analysis. A Primer*. University Press, Cambridge.

Isermeyer, F. (2016): Visionen für die Agrarpolitik. Presentation by Prof. Folkhard Isermeyer to the Heinrich-Böll-Stiftung, 5 September 2016, Berlin. https://www.thuenen.de/de/thema/langfristige-politikkonzepte/gap-nach-2020-ist-eine-grundlegende-agrarreform-moeglich/visionen-fuer-die-agrarpolitik/

Kuhfeld, W. F. (2005): Experimental design, efficiency, coding, and choice designs. In: *Marketing research methods in SAS: Experimental design, choice, conjoint, and graphical techniques*, 47–97.

Louviere, J.J. und G. Woodworth (1983): Design and Analysis of Simulated Consumer Choice or Allocation Experiments: An Approach based on Aggregate Data. *Journal of Marketing Research* 20(4), 350–367.

Louviere, J. J., Hensher, D. A. and J. D. Swait (2000): *Stated Choice Methods. Analysis and Application*. Cambridge: Cambridge University Press.

McFadden, D. (1974): Conditional Logit Analysis and Qualitative Choice Behavior. In: P. Zarembka (ed), *Frontiers in Econometrics*, Academic Press. New York, 105 – 142.

McFadden, D. and K. Train (2000): Mixed MNL Models for Discrete Response. Journal of Applied Econometrics, 15(5), S.447–470.

Schulz, N. (2013): Discrete Choice Experimente zur Prognose des Entscheidungsverhaltens von Landwirten. Dissertation. Christian-Albrechts-Universität, Kiel.

Train, K.E. 2003. *Discrete Choice Methods with Simulation*, Cambridge: Cambridge University Press.

WBA (Wissenschaftlicher Beirat für Agrarpolitik beim BMEL) (2010): EU-Agrarpolitik nach 2013. Plädoyer für eine neue Politik für Ernährung, Landwirtschaft und ländliche Räume. Gutachten Mai 2010. *Berichte über Landwirtschaft*, 88(2) September 2010, 173-202.

Annex 1: Descriptive statistics

N= 434 **Farm-specific variables**	**Mean (standard deviation)**	**Legend**
Age in years	36.4 (13.4)	Framer's age
Professional agricultural training	8.9% (28.6%)	Dummy variable
Accredited manager, agricultural expert, vocational training	30.4% (46%)	Dummy variable
Tertiary qualification or university degree	48.8% (50%)	Dummy variable
Non-agricultural training or studies	8,9% (28.6%)	Dummy variable
Succession	63.6% (48.2%)	Dummy variable for succession (1= secured succession)
Farming as main occupation	80.9% (39.4%)	Dummy variable for farming as main occupation (1= yes)
Federal states: Lower Saxony Schleswig-Holstein North Rhine-Westphalia Bavaria Baden-Württemberg Mecklenburg-Vorpommern	 32.2% (46.8%) 18.4% (38.8%) 11.9% (32.5%) 11.3% (31.7%) 5.7% (23.3%) 5.3% (22.4%)	
Cash crop farming	224.5 (446)	Land area in hectares
Dairy cattle farming	51 (132)	Number of dairy cows on the farm
Suckler cow farming	7 (35)	Number of suckler cows on the farm
Cattle fattening	19 (71)	Number of beef cattle on the farm
Pig fattening	377 (986)	Number of fattening places on the farm
Sows/piglet production	40 (232)	Number the breeding sows on the farm
Poultry	1003 (6689)	Number of spaces on the farm
Renewable energies	256 (569)	Kilowatts of installed electrical power
Problems with N surplus	20.7% (40.6%)	"Have you ever had problems complying with the permitted nitrogen surplus on a three-year average of 60 kg nitrogen per hectare?" Dummy variable (1= yes)
Participation in flower strip programmes	40.3% (49%)	"Have you ever taken part or are you currently taking part in voluntary ecological programmes (nature conservation, flower strip programmes *etc*.)?" Dummy variable (1= yes)
Participation in animal welfare programmes	18.4% (38.8%)	"Have you ever taken part or are you currently taking part in voluntary animal welfare programmes (*e.g.* "Animal Welfare Initiative" etc.)?" Dummy variable (1= yes)
Quantity control	3.9 (1.3)	"The state should support current milk prices through quantity control." 1= agree completely; 5= completely disagree
State subsidies	2.3 (1.3)	"In future farming should no longer be subsidised by the state" 1= agree completely; 5= completely disagree
Biodiversity	1.7 (1.0)	"Farming makes an important contribution to biodiversity in the agricultural landscape."

		1= completely agree; 5= completely disagree
Farmers protect animals	2.1 (1.0)	"Farmers protect animals and put animal welfare above financial success." 1= completely agree; 5= completely disagree