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Public Evaluation and Political Acceptance of Sustainable Land Use Polices: A populist democracy policy failure?

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Abstract This paper studies the ability of the political process to design public policies implying an effective and efficient provision of global and local environmental public goods. While it is commonly accepted that the market is unable to guarantee an efficient provision of public goods, such as environmental protection or food security, the question is if or under which condition political processes are efficient mechanisms of public good provision. Beyond policy failure due special interest politics policy failure also results from the fact that economic processes are often rather complex and hence laymen use simple mental models (political beliefs) to understand policy impacts. If political beliefs are biased political decision-making based on public opinion leads to rather inefficient policies establishing the paradox of *populist democracy policy failure*. We use own choice experiment data on sustainable land use policy in Germany to estimate econometrically the WTP for relevant global and local environmental public goods as well as voters' *political willingness-to-vote* for specific land use policies. Based on these estimations we derive underlying political belief. Further, we assess to what extend a *populist democracy policy failure* results, i.e. to what extend policy choices driven by political beliefs imply inefficient land use policies when compared to the counterfactual evidence-based policy choices driven by model-based technological relations.

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1 introduction

This paper studies the ability of the political process to design public policies implying an effective and efficient provision of global and local environmental public goods. While it is commonly accepted that the market is unable to guarantee an efficient provision of public goods, such as environmental protection or food security, the question is if or under which condition political processes are efficient mechanisms of public good provision.

This question is certainly not new, e.g. political economy theory of agricultural policy has identified specific properties of the political process that imply biased political outcomes. Special interest politics is a famous mechanism explaining persisting inefficient agricultural trade policies as the consequence of politically powerful farm lobbies (Swinnen et al., 2000; Anderson, 1995). However, especially more recent agricultural policy outcomes, e.g. greening land use policy or restriction of the use genetically modified material, seems to be much more driven by a populist public opinion expressing new consumers demands for and attitudes in favor of a sustainable land use than by farm lobbies. Thus, as these policies are obviously driven by the public opinion these policies appear as the result of a fundamental unbiased democratic process freed from any biased lobbying activities of vested particular interests. Thus, can we conclude that these new consumer driven agricultural policy overcomes policy failures of the old days?

In this regard Caplan (2001) as well as other scholars (Akerlof, 1989; Sachs, 1994) suggested an interesting different source of political failure. In particular, Caplan (2001) argued that the relation between economic policies and implied political outcomes is rather complex. To cope with this complexity laymen apply naive mental models to understand how policies translate into policy outcomes, i.e. agents form political beliefs. Some scholars (Rhoads, 1985; Walstad, 1996; Blendon et al., 1997; Caplan, 2002) compared economic beliefs, i.e. simple mental models how economic policy translates into economic performance, with corresponding expert beliefs of trained economist. Especially, based on comprehensive statistical analyses Caplan came to the conclusion that laymen beliefs systematically differ from experts beliefs. In particular, he concluded that these differences result form judgemental anomalies of the general public, while economic experts at least in average hold unbiased and true beliefs. Hence, based on this empirical finding Caplan as well as other scholars (Akerlof, 1989; Sachs, 1994; Caplan, 2001) further concluded that political failure is much more a byproduct of voter's systematically biased beliefs about economics than the product of special interest politics. Moreover, based on Caplan's empirical result that political experts have unbiased or at least less biased political beliefs when compared to laymen implies the following paradox of populist democracy policy failure: The more electoral competition implies an unbiased aggregation of societies interest, i.e. policy failure due to special interest politics is excluded, the higher is the risk of a populist democratic policy failure induced by a systematically biased public opinion.

Interestingly, populist democracy policy failure is not a complete new idea, for example it has already been identified by Adam Smith in his specific analysis of state restrictions of grain trading as a response to domestic food shortage. In particular, Smith nicely elaborated the fact that restricting international trade in response to a domestic food crisis is based on a wrong policy belief that high gain prices are the source of food crisis and result from acquisitiveness of grain traders,

while in fact high grain prices are caused by low domestic production and induce c.p. an supply increase preventing or at least attenuating food crisis.

Pars pro toto we consider the most recent political discussion on sustainable land use policy as an interesting case in point for populist democracy policy failure. In particular, we focus on biogas production in Germany. While the subsidization of bio-energy production is strongly supported by the general public as an essential component guaranteeing a sustainable energy production, the increased use of maize production, as the main substrate input to biogas production, is increasingly criticized. Keywords like '*maize deserts* ' dominate the public opinion indicating the presumed negative impact of maize production on local public environmental goods like for example landscape conversation, bio-diversity or nitrogen leaching. Moreover, an increased land use for maize production is criticized as it further reduces scare land resources available for food production or nature conversation. Accordingly, political acceptance of biogas subsidization decreased significantly forcing politicians finally in 2012 to follow the public opinion and restrict maize production for bio-energy use. In contrast to the public opinion scientific experts agree that maize is the most productive substrate for biogas production. Thus, a restriction of maize production reduces the efficiency of biogas production. Hence, there is a trade-off between the provision of the global environmental public goods 'climate protection', and the provision of local environmental public goods, i.e. landscape conversation, bio-diversity and nitrogen leaching.

From a welfare economic perspective, a restriction of maize production would only be justified, if this trade-off is positive, i.e. the reduction in global public goods is overcompensated by the increase in the provision of local public goods. Therefore, beyond the preferences for various global and local public goods, an optimal policy choice needs to be informed on the technological relations between land use and the induced provision of global and local public goods. However, voters are fundamentally uncertain regarding these technological relations. Hence, voters apply simple mental models (political beliefs) to approximate these unknown relations. Obviously, voters' policy preferences regarding alternative land use policies are based on their individual political beliefs, while an adequate public evaluation of land use policies is based on the true technological relations. Thus, to the extend political beliefs are biased political acceptance differs from public evaluation and the political process implies inefficient policy choices.

In this context the paper uses a own survey of choice experiment data including 1000 respondents collected in 2012 to estimate the standard *economic* willingness to pay for different global and local environmental goods. To take heterogenous preferences into account a latent class approach is applied. In a second step we estimate the political acceptance of alternative land use policies applying a probabilistic voter model approach using the same data set. Based on the specified probabilistic voter model a *political* willingness to pay for different land use policies can be calculated. Moreover, based on the combined estimates of the *political* and *economic* willingness to pay we are able to estimate corresponding individual political beliefs of voters. Finally, we derive the 'true' technological relations between land use policies and implied provision of global and local environmental public goods from a linked ecological and economic model. The model is empirically specified for Schleswig-Holstein, a state in Germany. Technically, the core economic model correspond to a regional LP-model incorporated 426 farm types defined for 22 natural subregions in Schleswig-Holstein, 4 farm size categories and

8 farm types. Each LP includes 960 production activities including 6 biogas production and 3 types of nature conservancy activities. The model includes farm's land endowment subdivided into 15 land quality categories. The ecological model provides for each production activity and land quality the nitrogen leaching as well as implied CO2-emissions.

Based on the comparison of estimated political beliefs and model-based technological relations we analyze public evaluation and political acceptance of alternative land use policies. In particular, we can quantitatively assess to what extend political acceptance differs from public evaluation, i.e. to what extend policy choices driven by political beliefs imply inefficient land use policies when compared to the counterfactorial evidence-based policy choices driven by model-based technological relations.

2 Theoretical framework

While it is commonly accepted that the market is unable to guarantee an efficient provision of public goods, such as environmental protection or food security, the question is if or under which condition political processes are efficient mechanisms of public good provision. In political theory electoral competition is understood as a fundamental democratic mechanism to guarantee that governmental policies reflect society's interests. In reality, however, electoral competition often leads to biased policy outcomes. Basically, in political economy theory policy biases result from two major mechanisms government capture and a lack of governmental accountability Bardhan and Mookherjee (2002). While government capture corresponds to special interest politics, i.e. the fact that electoral competition results in a over-representation of well-organized vested particular interests at the expense of the general public **?**, the latter corresponds to the fact that the political elite has only little incentive to represent societies interest, but rather acts selfish selecting policy maximizing their own individual welfare. Although government capture as well as a lack of accountability are phenomena rooting in voter behavior **??**, more recently Caplan (2001) as well as other scholars (Akerlof, 1989; Sachs, 1994) suggested a different explanation for political failure. In particular, Caplan (2001) argued that the relation between economic policies and implied political outcomes is rather complex. To cope with this complexity laymen apply naive mental models to understand how policies translate into policy outcomes, i.e. agents form political beliefs. For example, considering real political decision-making problems the number of political instruments is rather large. Therefore, voters often reduce complexity via reducing the dimensionality applying ideologies. Ideologies can be understood as macro-policy instruments resulting as latent factors from correlations of policy positions in the original policy space. In an extreme case agents focus on only one dimension. For example, multi-functionality or pro-poor growth or agricultural based growth are ideologies that can be interpreted as one dimensional macro political strategies. Of course the focus on ideologies (macro policies) might change over time, for example nowadays multi-functionality or sustainability are popular ideologies used in agricultural policy, while in the 80tees protectionism versus liberalization might have been more prominent ideologies used to reduce complexity of agricultural policy. Complexity reduction, however,

comes at a price, i.e. perception of policies as ideologies (macro-policies) implies that perceived policy impact is also biased [1].

Some scholars (Rhoads, 1985; Walstad, 1996; Blendon et al., 1997; Caplan, 2002) compared economic beliefs, i.e. simple mental models how economic policy translates into economic performance, with corresponding expert beliefs of trained economist. Especially, based on comprehensive statistical analyses Caplan came to the conclusion that laymen beliefs systematically differ from experts beliefs. In particular, he concluded that these differences result form judgemental anomalies of the general public, while economic experts at least in average hold unbiased and true beliefs. Hence, based on this empirical finding Caplan as well as other scholars (Akerlof, 1989; Sachs, 1994; Caplan, 2001) further concluded that political failure is much more a byproduct of voter's systematically biased beliefs about economics than the product of special interest politics. Moreover, based on Caplan's empirical result that political experts have unbiased or at least less biased political beliefs when compared to laymen implies the following fatal voting paradox: The more electoral competition implies an unbiased aggregation of societies interest, i.e. excludes governmental capture and increases governmental accountability, the higher is the policy failure.

To formalize our argument denote by z a vector of relevant public goods related with sustainable lad use, e.g. z includes global public goods like reducing climate change (carbon emissions), animal welfare and nature conversation, as well as local public goods such as water quality, landscape conversation or biodiversity.

Voter value public goods, where V(z,y-c) denotes voters utility derived from various public goods z and the available income y-c, where c correspond to the cost to provide public goods z.

However, voter can not directly choose public goods, but rather public good provision results as a byproduct from agricultural protection. The latter is politically determined by a set of land use policies. Let x denote the vector of relevant land use policies, then public good provision implied by land use policy x results from the political technology T(z,x).

In general, voters policy preferences can be derived from the following maximization problem:

$$\begin{aligned} &\max_{x} V(z, y-c) \\ &s.t. \\ &T(z,x) = 0 \\ &e'x = c \end{aligned} \tag{1}$$

x is the vector of budget expenditures per capita for different policy programs x, where z is a vector of relevant public goods and e' x = c are the political costs involved to provide the public good, while y is the per-capita income. Hence, final policy choices depend on voters preferences for public and private goods V(z,y-c) and the political technology T, respectively. Voters are fundamentally uncertain regarding the political technology T. Hence, they use simple mental models to approximate T. In particular, let A denote a simple linear mapping of policies into public goods. For example, A can be understood as a first order

[1] However, if agents mental capacity is rather limited ideology as a naive mechanisms to reduce complexity is the only way to deal with complex political decision-making.

Taylor approximation of the true political technology T. Accordingly, we denote voters beliefs by $\tilde{A}$, where it holds:

$$z = \tilde{A}x \tag{2}$$

If voters beliefs are extremely biased, i.e. $\tilde{A}$ is very different from the correct approximation A of T, voters policy preferences will be extremely biased implying that voters prefer policies $x*$, which are very different from voters true ideal point, i.e. policies that maximize voters preferences V(z,y-c) given the true political technology.

Accordingly, to asses whether Caplan's hypothesis is correct, i.e. wether empirically policy failure is mainly determined by voters' biased policy beliefs, one can estimate both voters' public good preferences V(z,y-c) and voters' policy preferences U(x).

Based on estimated preference voters' underlying political beliefs $\tilde{A}$ can be estimated. Comparing believed and true technical relations we can access to what extend political beliefs are biased and cause policy failure.

In particular, assuming voters public good preferences can represented by the following linear approximation (Haener et al., 2001):

$$V(z, y-c) = \sum_k \beta_k Z_k + \beta_0 (y-c) \tag{3}$$

, while voters' policy preferences can be represented by the following linear approximation:

$$U(x) = \sum_m \alpha_m X_m \tag{4}$$

Then, it follows for corresponding parameters of U and V:

$$\alpha = \tilde{A}'\beta \quad \Leftrightarrow \quad \alpha_m = \sum_k \tilde{a}_{km}\beta_k \tag{5}$$

Accordingly, if one has sufficient observations for the preference parameters of α and β one can estimate the corresponding political beliefs $\tilde{A}$.

Moreover, we can derive the willingness-to-pay for the provision of a public good z from:

Given the linearly additive indirect utility function it is straightforward to calculate the willingness-to-pay (WTP) for a public goods Z_k as the marginal rate of substitution between public goods and the cost to provide these:

$$WTP_k^z = \frac{\beta_k}{\beta_o} \tag{6}$$

Accordingly, the willingness to pay for a policy instrument X_m results as:

$$WTP_m^x = \sum_k \frac{\beta_k}{\beta_o}\tilde{a}_{zm} - 1 = \sum_k WTP_k^z \tilde{a}_{zm} - 1 \tag{7}$$

Now to reduce complexity assume voters perceive land use policies in a one dimensional macro instrument, say multi-functionality. Multi-functionality can be understood as a latent factor (X^F) determining different land use policies:

$$x = a^F X^F \tag{8}$$

, where $a^F = [a_m^F]$, where a_m^F is the factor loading of multi-functionality for the policy instrument m. Moreover, from factor analysis we know that we can also define a corresponding vector of factors scores $b^F = [b_m^F]$, where it holds:

$$X^F = b^F x \tag{9}$$

Accordingly, the true willingness-to-pay for an increase in a further orientation of land use policy towards more multi-functionality results as:

$$WTP^F = \sum_m \sum_k \frac{\beta_k}{\beta_o} \tilde{a}_{zm} a_m^F - 1 = \sum_m \sum_k WTP_m^x a_m^F \tag{10}$$

In this regard we argue that complexity reduction implies a systematic bias of the impact of specific policies. The logic of our arguments is as follows. Assume voters perceive land use policies in terms of multi-functionality as ideological macro dimension. Accordingly, multi-functionality is a latent factor as defined above. Hence, when voters evaluate a change in a specific policy instrument, say space implies that voters first calculate how a change in a specific policy impact on the multi-functionality, this corresponds to the factor score b_m^F and then they evaluate how the perceived change in multi-functionality impact on their utility via multiplying b_m^F by WTP^F, the willingness-to-pay for an increase in this orientation.

Thus, overall it holds:

$$\tilde{W}TP_m^x = b_m^F WTP^F \tag{11}$$

Please note that the ideological perception of the impact of a specific policy on voters well-being implies a systematic bias when compared to the true welfare impact corresponding to the true willingness-to-pay, i.e.‘in general it holds $WTP_m^x \neq \tilde{W}TP_m^x$.

In particular, please note that for example a specific land use policy like the reduction of nitrogen leakage only impact on a single environmental good, e.g. water quality, while multi-functionality impacts on the full set of environmental goods, e.g. including climate change, nature conversation, biodiversity,etc.... Thus, policy perception in a ideological macro space induces a systematic bias, since a specific policy is first translated in to a shift of the ideological dimension and then the policy impact of this shift is evaluated. Technically, complexity reduction via political ideology implies that voter apply the wrong directional derivative when evaluating a change in a specific single policy.

Beyond this systematic change due to complexity reduction voters beliefs regrading the impact of single policies on the provision of public goods is also in general biased, i.e. $\tilde{A} \neq A$.

In the following we test empirically for political belief biases.

3 Methodological approach

To estimate empirically public preferences V(z), policy preferences U(x) as well as underlying political beliefs we apply discrete choice experiments (DCE) to estimate both public good preferences and policy preferences. Nowadays, DCEs are standard approach to estimate preferences for non-market goods, especially DCE is used for evaluations of environmental public goods **?**. Moreover, DCEs are the standard approach to estimate probabilistic voter models which is nowadays the work horse approach in empirical election studies (Thurner, 1998; **?**).

As the theoretical foundation of DCEs are well documented in the existing literature (Lancaster, 1966; **?**) we omit further explanation here [2], but will describe our econometric models as well as study design and data used in the next subsections.

3.1 Econometric models

Discrete choice models derived in a random utility model (RUM) framework assume that decision makers choose between two or more discrete alternatives and behave as expected utility maximizers. In the case of spatial models, the voter supports the candidate or the party who maximizes his combination of measured policy-related utilities and his unmeasured utilities (Adams et al., 2005). Assume there are J alternatives for a decision maker. Thus the decision maker i chooses the party j if and only if

$$U_i(j) > U_i(j'), \forall j \neq j'. \tag{12}$$

In random utility models one presumes that the utility $U_i(j)$ provided to individual i by alternative j is composed of a deterministic component $V_i(j)$, which can be calculated based on observed characteristics, and a stochastic error component ϵ_{ij}, which is unobserved, so that the formula for a random utility model determining only policy factors is given by

$$U_i(j) = V_i(j) + \epsilon_{ij}, \tag{13}$$

where ϵ_{ij} is a voter-specific random utility term which represents unmeasured components of the voter i's utility for a party j. Note that in all discret choice models, the absolute level of utility is irrelevant. The choice probability is $P_{ij} = Prob(U_i(j) > U_i(j')) = Prob(U_i(j) - U_i(j') > 0)$, which depends only on the difference in utility and not its absolute level.

The conditional logit model (McFadden, 1974) can be utilized to estimate these probabilities if the random terms are assumed to be independently distributed Type-I extreme value variates. Let y_{it} denote the value of the dependent variable for individual i at replication t, which can take on values $1 \leq j \leq J$. We use vector notation $\mathbf{y_i}$, $\mathbf{z}_i^{cov}$, $\mathbf{d}_{it}^{att}$, $\mathbf{k}_{it}^{pre}$ to refer to all responses, all co-variate values for individual i, the attribute and predictor values corresponding to individual i

[2] We refer the interested reader to (**?**).

at replication t. The conditional logit model for the response probabilities has the form (Vermunt and Magidson, 2005):

$$P(y_{it} = j|\mathbf{d}_{it}^{att}, \mathbf{k}_{it}^{pre}) = \frac{exp(V_{it}(j))}{\sum_J exp(V_{it}(j'))}, \tag{14}$$

where $V_{it}(j)$ is the systematic component in the utility of alternative j for individual i at replication t. The term $V_{it}(j)$ is a linear function of an alternative-specific constant α_j, predictor effects γ_{lj} and attribute effects β_n. That is,

$$V_{it}(j) = \alpha_j + \sum_l \gamma_{lj} Z_{lit} + \sum_n \beta_n Z_{itj}^n, \tag{15}$$

Thus, the regression parameters corresponding to the predictor effects γ_{lj} are alternative specific.

3.1.1 Heterogeneous Preferences in Random Utility Models and Latent Class Analysis

When unobserved heterogeneity in the population is forecasted, this will lead to a class of response models based on random utility maximization (McFadden and Train, 2000). There are mainly two types of models based on the idea of using a mixture of a simple underlying model, such as multinomial logit, over the distribution of preferences: mixed multinomial logit models (MMLM) and latent class logit models (LCLM). While in MMLM this distribution is continuous, in the latent class context, a finite number of classes are used to express the heterogeneity. Both types of models are random utility maximization (RUM) models generalizing standard logit by allowing the parameter associated with each observed variable to vary randomly across individuals. Although mixed logit models explicitly account in a sense for heterogeneity, latent class analysis is better suited to explain the sources of heterogeneity that relate to the characteristics of individual consumers (Boxall and Adamowicz, 2002).

Hence, we concentrate in this paper on the latent class analysis (LCA), since it uncovers unobserved heterogeneity in a population and aims to find meaningful groups of voters that are similar in their responses to measured variables. In a LCA, the parameter heterogeneity across individuals is modeled by a discrete distribution or set of classes. The estimation results in a fixed number of classes, thereby the parameters of statistical model differ across these latent classes formed by unobserved latent variables. Thus, preferences of voters are homogeneous within each latent class, but can vary between the classes.

Latent Class Estimation of this paper was realized in Latent GOLD Choice 4.0, developed by Vermunt and Magidson (2005). The regression model that is used in Latent GOLD Choice 4.0 is the conditional logit model developed by McFadden (1974) (Vermunt and Magidson, 2005). Latent GOLD Choice implements a nonparametric variant of the random-coefficient or mixed conditional logit model (McFadden and Train, 2000; Vermunt and Magidson, 2005). From three possible methods in Latent GOLD Choice 4.0 based on different response formats ($first$ *choice*, *ranking task*, *rating task*), $first$ *choice* format was selected as most suitable method concerning the assumption that each choice set has the same number of alternatives. Since random utility theory is first employed to model choices among

a set of substitutes or alternatives, we give at first its formalisation. Next, we formulate conditional and latent class models.

In a latent class or finite mixture variant of the conditional model, it is assumed that individuals belong to different latent classes that differ with respect to the parameters appearing in the linear model for $V_{it}(j)$. In order to indicate that the choice probabilities depend on class membership x, the logistic model is now of the form:

$$P(y_{it} = j|c, \mathbf{d}_{it}^{att}, \mathbf{k}_{it}^{pre}) = \frac{exp(V_{it|c}(j))}{\sum_J exp(V_{it|c}(j'))}, \tag{16}$$

Here, $V_{it|c}(j)$ is the systematic component in the utility of alternative j given that individual i belong to latent class c. As can be seen, the logit regression coefficients are class specific and the linear model for $V_{it|c}(j)$ in this specific case is:

$$V_{it|c}(j) = \alpha_{cj} + \sum_l \gamma_{clj} Z_{it}^l + \sum_n \beta_{cn} Z_{itj}^n. \tag{17}$$

In addition to the attributes and predictors, we include in our latent class analysis another type of explanatory variable - covariates - in the the LC model. While attributes enter in the regression model for choices, covariates are used to predict class membership. When covariates are included in the model, the probability density becomes the following form (Vermunt and Magidson, 2005):

$$P(\mathbf{y_i}) = \sum_{c=1}^{C} P(c|\mathbf{w}_i^{cov}) \prod_{t=1}^{T_i} P(y_i|c, \mathbf{z}^{\mathbf{n}att}_{it}, \mathbf{z}^{\mathbf{l}pre}_{it}), \tag{18}$$

where class membership of individual i is now assumed to depend on a set of covariates denoted by $\mathbf{w}_i^{cov}$.

Given the linearly additive indirect utility function it is straightforward to calculate marginal rate of substitution between attributes as the ratio of the marginal utility of an attribute k and a specific reference attribute 0:

$$\frac{\beta_k}{\beta_o} \tag{19}$$

Especially, if one component of alternatives corresponds to a payment attribute and this attribute is used as the reference alternative the marginal rate of substitutions corresponds to the willingness-to-pay (WTP) for a attribute k.

Further, compensating surplus welfare estimates (CS) for two alternative provision of public goods, say 0 and 1 result as:

$$CS = -\frac{1}{\beta_o} \left[\sum_k \beta_k (j_k^0 - j_k^1) \right] \tag{20}$$

In our study we apply DCEs using a latent class approach as described above to estimate public good preferences V(z) and policy preferences U(x), respectively. Accordingly, we design two different DCEs. In the first DCEs the alternatives are

different scenarios for the provision of global and local public goods, z, and the corresponding costs c. Thus, for this analysis the utility driving choices is defined as:

$$V(z,c) = \sum_k \beta_k Z_k + \beta_c C \tag{21}$$

For the second DCE the alternatives are relevant political parties in Germany, where the attributes include the euclidian differences (z^n) between party and voter positions regarding relevant policies (x).

Moreover, following standard probabilistic voter models we include voter's retrospective estimation of past governmental performance (z^l)as well as specific non-policy indicators as additional attributes (α) determining voter's utility from the choice of a specific party [3]

$$V_z = \alpha_c + \sum_l \gamma_{cl} Z^l + \sum_n \beta_n Z^n. \tag{22}$$

Hence, in general no payment attribute is used in probabilistic voter models. Nevertheless, analogously to WTP's the marginal rate of substitution between specific policy issues and a defined reference policy issue can be interpreted as a political willingness-to-vote (WTV). WTV express the relative importance of a policy issue in comparison to the reference issue. Alternative, one could also use the sum marginal utilities of all policy issues as a reference to calculate WTV. In the latter case WTV for a specific policy issue correspond to the relative increase in the probability that a voter votes for a party assuming the party position is moved towards a voter's ideal position.

In following, we specify describe study design and data used to estimated LC models for public good preferences V(z) and policy preferences U(x), respectively.

3.2 Survey design and data

3.2.1 Public good experiment design

Following the literature on sustainable land use we considered the following environmental public goods: (Z1) carbon emission (climate change), (Z2) animal welfare, ((Z3) conversation of nature, (Z4) food quality and safety, (Z5) water quality, (Z6) biodiversity, (Z7) variety of landscape. In particular, we considered Z1-Z4 as global public goods , while we considered Z5-Z7 as local public goods, where global public goods are public goods provided to the total German populations or even to a larger population including the German population, while local public goods are public goods provided only to a subsect of the German population at regional or local level, e.g. ithin a community. We designed two separate choice experiments one for global and one for local public goods. For each

[3] Beyond policy indicators voters also apply non-policy indicators to estimate their future utility expected assuming a candidate is elected. Non-policy oriented indicators correspond to the concept of valence (Stokes, 1963; Groseclose, 2001; Schofield, 2004), that is based on specific characteristics (z_I) like appearance, charisma, occupation or ethnicity, voters perceive a specific competence or popularity of candidates and parties.

experiment we defined the provision of a specific environmental public good as a separate attribute, each with three levels (ranging form minimal, medium and maximal level) included in the CE. An additional monetary attribute, the cost per household involved for provision of public goods, was selected to capture WTP for the public goods. Cost based on cost estimates derived from present land use policies. The environmental public goods as well as the applied provision and cost levels are presented in table 1.

Attributes and their levels were combined according to an experimental design to create choice sets. A full factorial design which includes all possible combinations of the attributes would yield 243 possible choice sets for global and 81 for local public goods. Since it is not practically feasible to work with such a large number of choice sets, an orthogonal main effects design combined with a blocking strategy was generated, where each block included 5 generic choice sets for global and 5 for local public goods. Each choice set consisted of three alternatives: a status alternative offered to the estimated present costs and two hypothetical alternatives. Blocks are randomly distributed to participants during online session.

3.2.2 Voter survey design

The central endogenous variable of the voter survey was voters party choice. Interviewees were asked which party they would vote in national parliamentary elections (Bundestagswahlen) if these elections will take place next Sunday.

Table 1 Party Choice of interviewees

Party	Abbr.	Votes,%
Christlich Demokratische Union Deutschlands	CDU	0.1983
Christlich-Soziale Union in Bayern e. V.	CSU	0.0037
Sozialdemokratische Partei Deutschlands	SPD	0.2143
Freie Demokratische Partei	FDP	0.0369
Buendnis 90/Die Gruenen	Gruene	0.431
Die Linke	Linke	0.0394
Piratenpartei Deutschland	Piraten	0.0763

Following the standard approach in empirical voter surveys policy distances were calculated based on voters perceived positions of the parties and their self-placement on relevant policy issue **??**). In particular, we subdivide macro and micro policy issue. The former includes the following three policy dimensions:

- *Economic Growth* (GRO): Environmental protection versus economic growth
- *Economic Policy* (ECO): Regulative versus market liberal policy
- *Social Policy* (SOC): Conservative versus progressive policy

Using the scale from one to seven, respondents place the parties and themselves concerning the issues above. Based on these policy preferences of voter and their beliefs about all parties in three dimensions, the squared (Euclidean) distances have been calculated for each dimension and for each of seven party, so that these twenty one distances have been taken as attributes (*policy* variables) in LCA.

Moreover, two additional policy dimensions were constructed from 11 specific land use policy dimensions (Z1-Z11). In particular, voters were ask how much

of their income in percent they would spent for sustainable land use, support of farmers, subsidizing bioenergy production, promoting animal welfare, food quality and safety, conversation of nature, reduction of climate change, water quality and landscape variety (i.e reduction of 'Vermaisung' , the latter defined as an expansion of maize production for bioenergy production).

The other questions were for example so: "How high or low should be the standards for agricultural production in their opinion?" and "Which income disparities between cities and rural areas would be acceptable in your view?". Please see table below for the definition of all policy issues.

Table 2 Factor loading matrix

Issue	Factor1 Multifunctionality	Factor2 Subsidies
Z3. Additional standards for agricultural production (no add.standards vs. standards organic farming)	**0.535**	0.354
Z6. Support of animal protection (no income reduction vs. 1% income reduction)	**0.649**	0.196
Z7. Support of food quality safety (no income reduction vs. 5% income reduction)	**0.619**	0.097
Z8. Support of climate protection (no income reduction vs. 1% income reduction)	**0.618**	0.229
Z9. Support of nature protection (no income reduction vs. 1% income reduction)	**0.814**	0.23
Z10. Support of water protection (no income reduction vs. 1% income reduction)	**0.776**	0.237
Z11. Support of landscape protection (no income reduction vs. 1% income reduction)	**0.662**	0.215
Z1. Support of sustainable land use (no budget expenditure vs. 1% per capita income)	0.352	**0.521**
Z2. Support of agriculture (no support vs. 50% farmer income from support)	0.04	**0.509**
Z4. Support of bioenergy (State subsidies vs. without subsidies)	-0.275	**-0.4**
Z5. Income disparities bet. cities and rural areas (no income disparities vs. disparities to 60%)	-0.102	**-0.383**

To identify voters underlying ideological space in which land use policies are perceived we conducted a factor analysis including voters positions for all 11 land use policy issues (Z1-Z11). The factor analysis suggested a two factors solution. Based on the factor loading structure we interpreted the first factor as Multifunctionality of agriculture ($F_1 = MULT$) and the second factor as subsidization ($F_2 = SUB$). Further, we calculated factor scores for each voter and parties for both factors and based on factor scores we could calculate squared distances between the ideological policy position of voter's and parties for both macro dimension, multi-functionality and subsidization, respectively. These macro-policy distances are included as further attributes in our latent class analysis.

Furthermore, we included the following socioeconomic characteristics as explanatory variables or determining covariate class-membership:

- Subjective Characteristics:
  - Gender (Gender): 1=male, 0=female
  - Age (Age)

  - Education (Education): 1=basic, 2=vocational, 3=secondary, 4=high school, 5=university
  - Total monthly income in Euro (Income): 1= less 1000 euro, 2=1000-2500 euro, 3=2500-5000 euro, 4=more 5000 euro
- Individual Satisfaction Characteristics:
  - Satisfaction with own economic situation (Sat): 1=very bad ... 5=very good
  - Satisfaction with an economic situation in country (Sat.Eco): 1=very bad ... 5=very good
  - Satisfaction with the Federal Government performance in the areas of environmental protection (Sat.Gov)[4]: -3=very bad ... 3=very good

All data has been collected via an online-survey undertaken in between October 2012 and April 2013. Overall, 1200 interviewees participated in the survey, of which 965 could be used for the frist and 823 for the second DCE.

4 Results

4.1 Public Good preferences

We estimated LCLM for two and three classes. To decide on the best number of the classes we regard the Akaike information criterion (AIC) and Bayesian information criterion (BIC). While the BIC assumes that the true generation model is in the set of candidate models, the AIC does not assume that any of the candidate models is necessarily true in order to make the best possible predictions. Most simulations that favor AIC over BIC assume that reality is high or infinitely dimensional (Wagenmakers and Farrell, 2004). To discover more heterogenous preferences of voters we decided for three class model with better AIC. Estimation results for the latent class model are presented in table 3.

[4] Based on the 6 areas of environmental protection (agriculture, climate change, nature protection, promotion of renewable energies, food quality and world nutrition), it was found one factor for satisfaction with government performance

Variable	Class1	Class2	Class3	Class4
klimaschutz	0.973	0.884	0.427	0.191
tierschutz	1.566	0.261	-0.069	-0.453
nahrungsmit	-0.309	1.002	0.52	-0.129
naturschutz	0.883	0.661	0.161	-0.084
zahlungent	0.141	-0.077	0.4	1.266
Class Share	0.213	0.487	0.224	0.077

Table 3 Choice model Parameters and average class shares

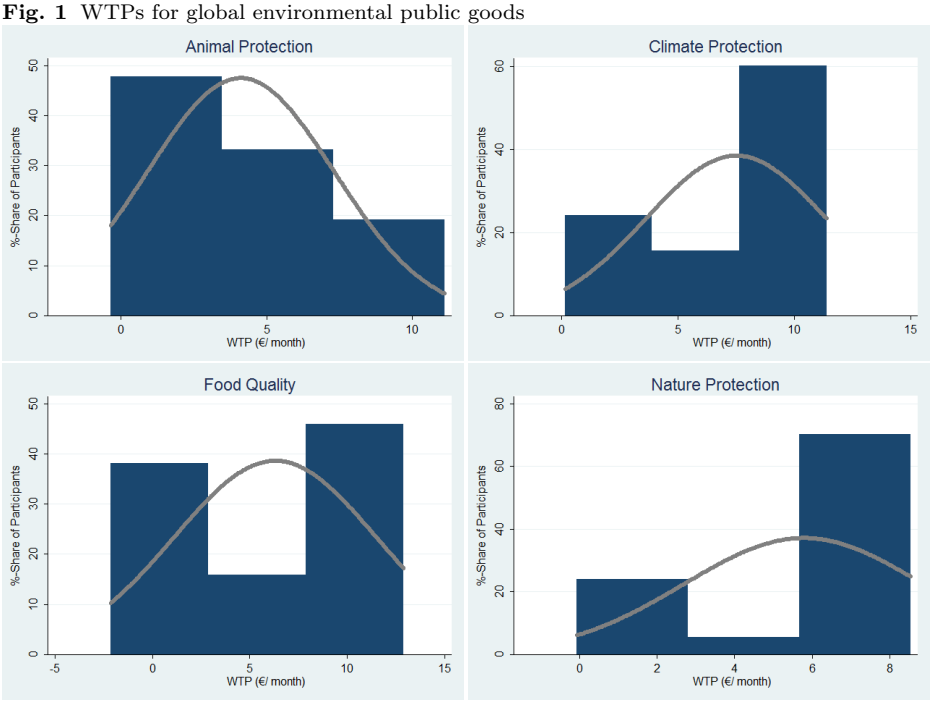
Variable	Class1	Class2	Class3	Class4
maledum	-2.02	-0.674	-0.648	0
age	-0.034	-0.003	-0.046	0
householdsize	0.09	0.073	0.068	0
income	-0.035	-0.004	-0.092	0
education	-0.053	0.172	0.153	0
cons	2.818	0.965	1.562	0

Table 4 Class Membership Parameters: Class 4 = Reference Class

Based on estimation results we calculated individual WTPs for different global (Climate change, conservation of nature, food quality and safety as well as animal welfare) and local goods (biodiversity, water quality and landscape diversity).

Results of estimated WTPs are presented in figure 1-7 below.

Fig. 1 WTPs for global environmental public goods



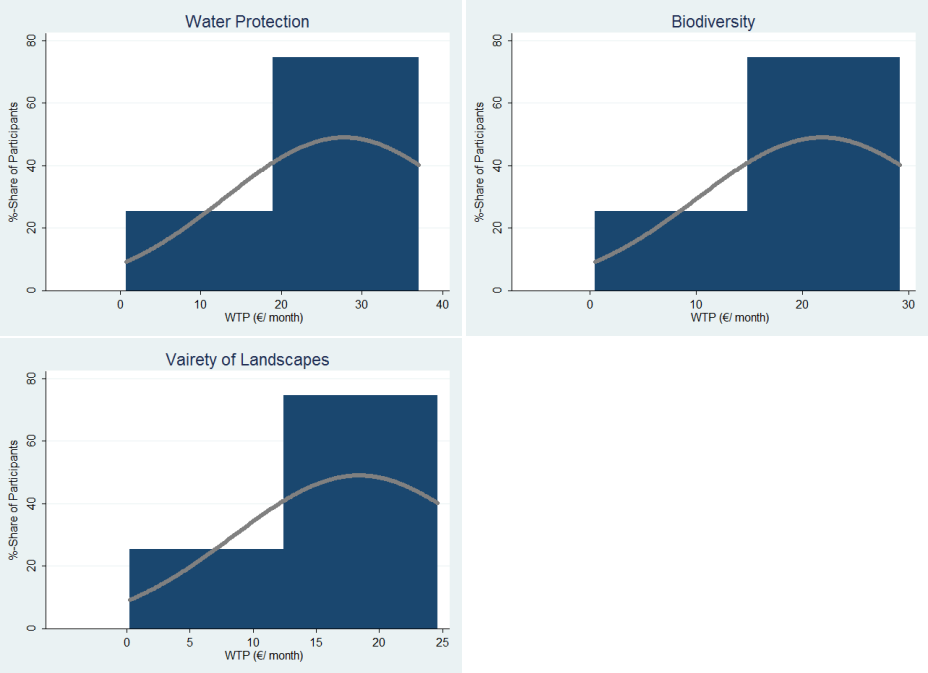
Variable	Class1	Class2
landschaflt	0.655	0.184
gewaessersz	0.986	0.552
artenvielft	0.777	0.35
gemeindeage	0.027	-0.727
Class Share	0.744	0.256

Table 5 Choice model Parameters and average class shares

Variable	Class1	Class2
maledum	-0.514	0
age	0.034	0
education	-0.067	0
householdsize	0.216	0
income	-0.019	0
cons	0.306	0

Table 6 Class Membership Parameters: Class 2 = Reference Class

Fig. 2 WTPs for local environmental public goods



4.2 Policy preferences

We estimated LCLM for two and three classes. To decide on the best number of the classes we regard the Akaike information criterion (AIC) and Bayesian information criterion (BIC). While the BIC assumes that the true generation model is in the set of candidate models, the AIC does not assume that any of the candidate models is necessarily true in order to make the best possible predictions. Most simulations that favor AIC over BIC assume that reality is high or infinitely dimensional (Wagenmakers and Farrell, 2004). To discover more heterogenous preferences of

voter we decided for three class model with better AIC. Estimation results for the latent class model are presented in table 7.

Table 7 Estimation results for 3-class model

	Class1	z-value	Class2	z-value	Class3	z-value
Constants						
CDU	2.150***	6.351	5.061	0.985	1.131	0.834
CSU	-2.207**	-2.022	-4.64	-0.185	0.176	0.109
SPD	1.309***	4.489	4.593	0.894	-0.575	-0.504
FDP	-0.170	-0.263	4.525	0.881	-3.001	-1.489
Gruene	1.223***	3.167	5.887	1.147	1.454	1.641
Linke	-2.464***	-2.92	-1.56	-0.172	1.91	1.456
Piraten	0.158	0.48	-13.867	-0.824	-1.096	-0.889
Attributes						
GRO	-0.027	-0.766	-0.053	-1.246	-0.525***	-2.707
ECO	-0.305***	-3.649	0.011	0.206	-0.913***	-2.925
SOC	-0.172***	-3.397	-0.034	-0.729	-2.173***	-2.604
MULT	-0.918***	-4.793	-0.094	-0.594	-1.983***	-2.389
SUB	-1.197***	-3.239	-0.504**	-2.166	-3.942***	-2.562
Satisfaction Gov. Performance						
CDU	0.27	0.936	-0.916	-0.189	1.072	0.802
CSU	0.032	0.026	-1.277	-0.046	-0.579	-0.347
SPD	-0.515	-1.61	-1.699	-0.349	3.276**	2.166
FDP	0.335	0.65	-0.993	-0.204	-6.592***	-2.783
Gruene	-0.561*	-1.802	-1.708	-0.352	2.171*	1.956
Linke	1.195**	2.069	-0.588	-0.078	0.018	0.017
Piraten	-0.756**	-2.282	7.181	0.861	0.634	0.519
ModelClasses						
Intercept	5.116***	2.93	-7.945***	-3.106	2.828*	1.821
Gender	0.203	0.729	-0.561	-1.544	0.358	1.166
Age	-0.006	-0.319	0.011	0.514	-0.005	-0.294
Education	-0.557***	-2.549	0.541**	2.021	0.016	0.083
Income	0.371 **	2.21	-0.457*	-1.706	0.086	0.437
Satisfaction economic situation	-0.044	-0.245	0.773***	2.77	-0.729***	-3.812
Satisfaction own situation	-0.243	-1.624	0.469**	2.183	-0.226	-1.214
Satisfaction Gov. Performance	0.003	0.019	-0.331	-1.608	0.328***	2.285
Class size	0.5494		0.2539		0.1967	
*** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$						

As can be seen from model, class 3 significantly determined by dissatisfaction with an economic situation votes most policy-oriented in all 5 dimensions compared with class 1 and class 2, while class 2 which significant satisfied with an economic situation in country and with own economic situation is at least pronounced by policy-oriented elections. Class 1 is the greatest class with 54,94% of all voters and regarding policy-oriented elections takes place between class 2 and class 3.

Further, we investigate implications of our estimation on voter behavior analyzing the relation between marginal effects and finding political WTPs. First, we calculate a relation of marginal effects for the factor $multifunctionality$ and marginal effects for dimension $growth$. Thereby, we are able to say to what extent the people are willing to donate an economic growth in order to develop multifunctionality. Second, we calculate also a relation of marginals effects for the factor $subsidies$ and marginal effects for $growth$ to identify to what extent the people are

willing to give up an economic growth to support financially an agriculture. Hence, the political WTP for *multifunctionality* related to *growth* for voter i and party j was calculated in the following way:

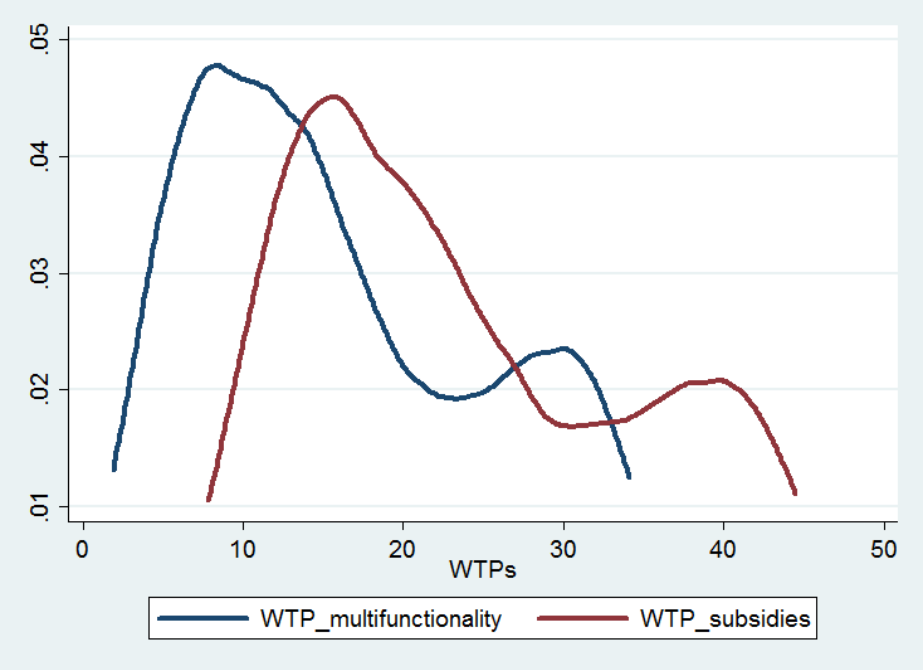
$$WTP_{ij}^{policy} = \frac{ME_{MULT}^{ij}}{ME_{GROWTH}^{ij}} = \frac{\sum_{c=1}^{C} Pr_c^i \frac{\partial Pr_c^{ij}}{\partial F^{ij}}}{\sum_{c=1}^{C} Pr_c^i \frac{\partial Pr_c^{ij}}{\partial D^{ij}}} \tag{23}$$

and over all parties:

$$\overline{WTP}_i^{policy} = \sum_{j=1}^{J} s_j * WTP_{ij}^{policy} \tag{24}$$

where s_j party shares.
Further, we do kernel density estimation for both WTPs.

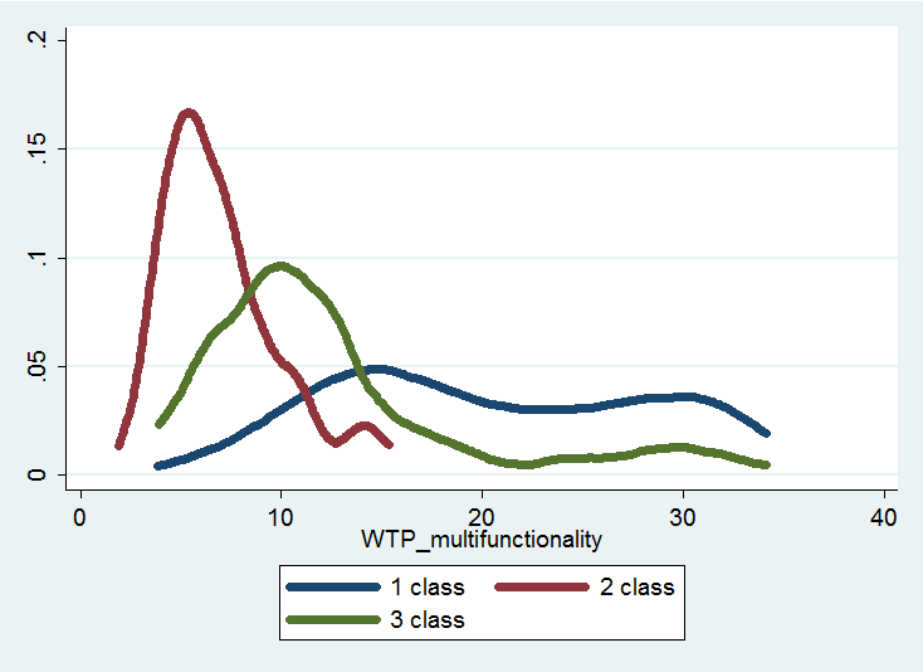
Fig. 3 Kernel density estimation for WTPs



As can be seen from plot 3, WTP for *multifunctionality* is smaller compared to WTP for *subsidies* indicating a higher political willingness to pay for support of farmers than multi-functionality, i..e promoting the provision of environmental goods. Moreover, we regard policy WTPs by classes:

Plot 4 provides evidence of heterogeneous policy WTPs across classes. People from class 2 with a significant higher education or lower income which vote

Fig. 4 Kernel density estimation for WTP multifunctionality by classes



not policy-oriented has the smallest WTP, while class 1 with inverse individual characteristics determining class membership significantly has the greatest WTP. Particularly, the people from the class 3 voting maximal policy-oriented have the middle WTP.

Furthermore, in our voter survey data we directly collected data on the willingness-to-pay for policies promoting global p(X6-X9) corresponding to Z1-Z4) and local (X9-X11 corresponding to Z5-Z7) public environmental goods.

Further, we can estimated the political WTP^x for the different global and local public environmental goods.These estimates are presented in figures below.

Fig. 5 Kernel density estimation for WTP multifunctionality by classes

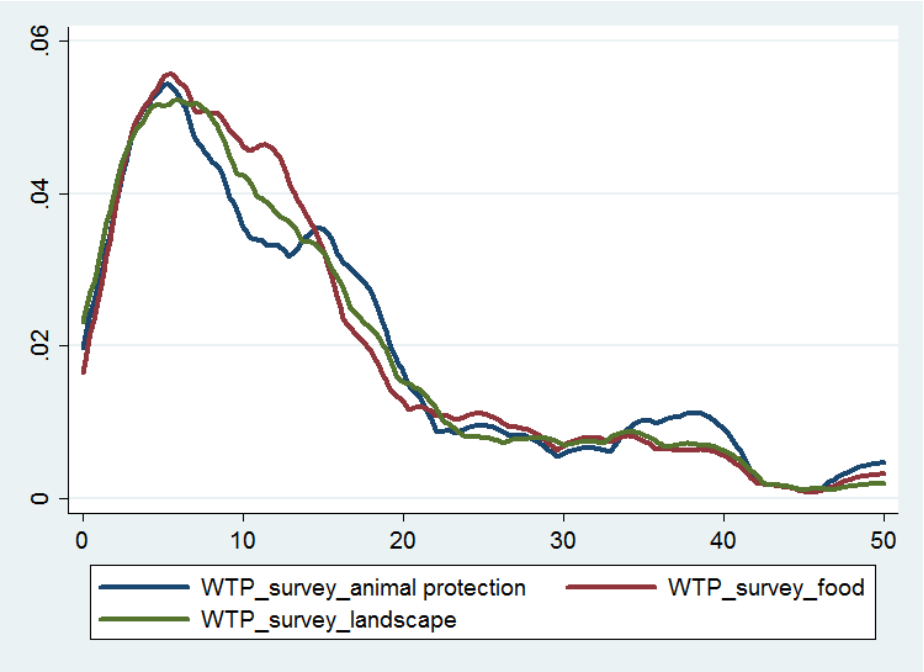
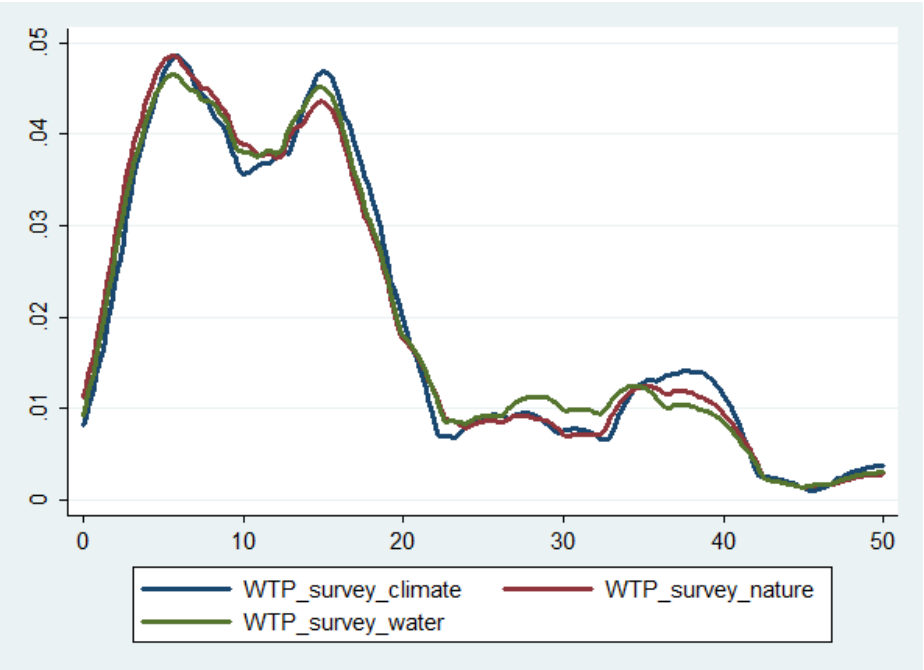


Fig. 6 Kernel density estimation for WTP multifunctionality by classes

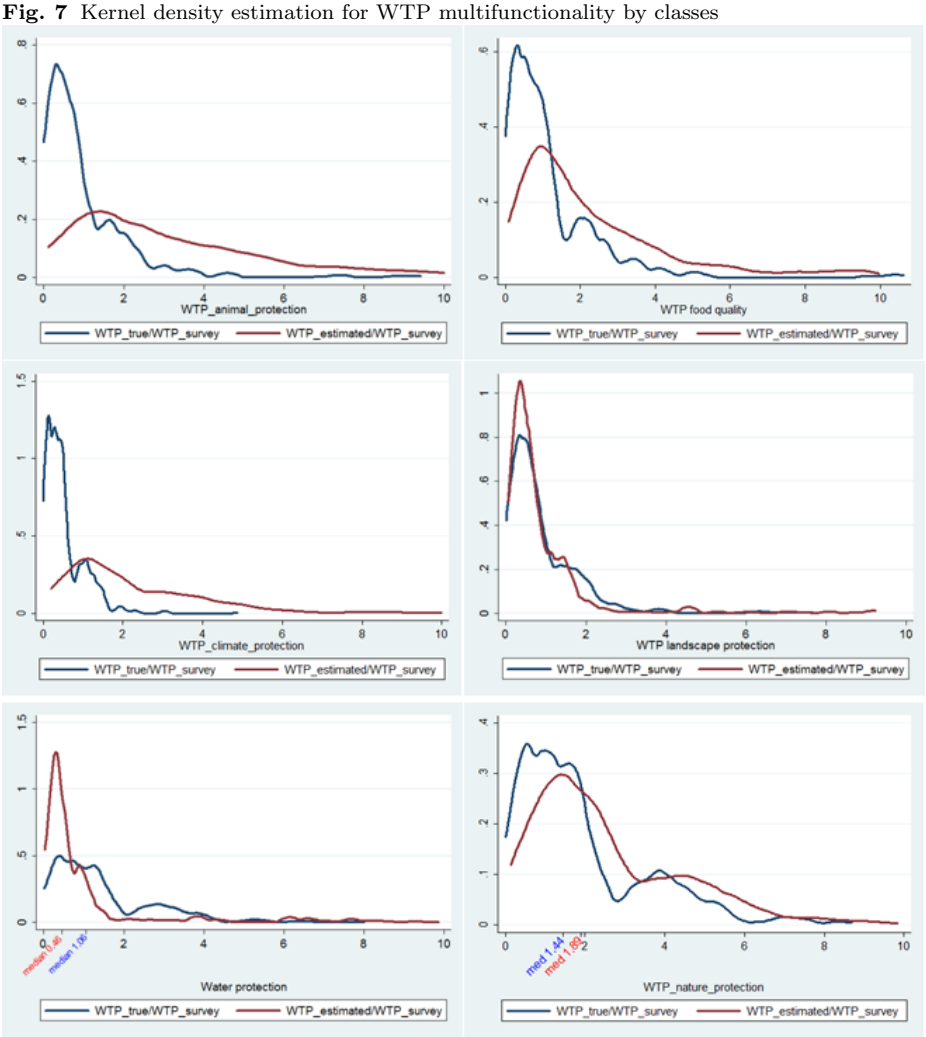


4.3 Political beliefs

Finally, as explained above we can calculate the perceived political WTP,$\tilde{WTP}^x$, taking into account that voterss perceive the policy impact of specific land use policy in via a latent multi-functionality dimension to reduce complexity. Further, to assess wether our DCEs confirm our hypothesis that complexity reduction via political ideology implies bias political beliefs we calculated for each individual voter the relation between t the empirically political WTP estimated based on the probabilistic voter model and the true political WTP, WTP_m^x, as well as the relation between the empirically political WTP and the calculated perceived WTP, $\tilde{WTP}_m^x$. Results are presented in figure 7 below.

As can be seen from this figures voters seem to overestimate political WTPs of specific land use policies, where a main source of this overestimation is implied by voters strategy to use multi-dimensionality as a latent macro policy dimension to cope with the complexity of understanding the technical impact of various land use policy on relevant environmental public goods and hence voters' welfare. The latter can be concluded from the fact that the relation of calculated perceived WTP $\tilde{WTP}_m^x$ and the empirically estimated political WTPs is much closer to 1 when compared to the corresponding relation between the true and the empirically estimated WTPs.

Fig. 7 Kernel density estimation for WTP multifunctionality by classes



5 Conclusion

This paper studies the ability of the political process to design public policies implying an effective and efficient provision of global and local environmental public goods. While it is commonly accepted that the market is unable to guarantee an efficient provision of public goods, such as environmental protection or food security, the question is if or under which condition political processes are efficient mechanisms of public good provision. Beyond policy failure due special interest politics policy failure also results from the fact that economic processes are often rather complex and hence laymen use simple mental models (political beliefs) to understand policy impacts. If political beliefs are biased political decision-making based on public opinion leads to rather inefficient policies establishing the paradox of *populist democracy policy failure*. We use own choice experiment data on sustainable land use policy in Germany to estimate econometrically the WTP for relevant global and local environmental public goods as well as voters' *political willingness-to-vote* for specific land use policies. Based on these estimations we derive underlying political belief. Further, we assess to what extend a *populist democracy policy failure* results, i.e. to what extend policy choices driven by political beliefs imply inefficient land use policies when compared to the counterfactual evidence-based policy choices driven by model-based technological relations. Based on our estimations we can conclude that land use policy in Germany is characterized by *populist democracy policy failure*.

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