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Choosing not to choose: A meta-analysis of *status quo* effects in environmental valuations using choice experiments

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ABSTRACT: Discrete choice experiments (DCE) normally include in their choice sets an option described as the status quo (i.e. no change to current situation; SQ). The literature has identified Status Quo Effect (SQE) as the systematic preference of the SQ over the alternatives that propose changes over and beyond what can be captured by the variation of attributes' levels. In this paper, we conduct a meta-analysis of DCE applied in environmental policy to identify potential drivers of SQE. We find that accounting for heterogeneity in the econometric analysis, excluding protest responses and easing the choice's cognitive burden reduce the presence of SQE.

KEYWORDS: Meta-analysis; choice experiments; *status quo* effect in environmental valuations.

Eligiendo no elegir: meta-análisis de los efectos de *status quo* en la valoración del medioambiente usando experimentos de elección

RESUMEN: Los experimentos de elección suelen incluir en sus opciones de elección un status quo (i.e. situación actual sin cambios, SQ). En la literatura se ha identificado el efecto SQ como una preferencia sistemática por el SQ sobre las demás alternativas más allá de las capturadas por la variación de los niveles de los atributos. En este artículo se presenta un meta-análisis de experimentos de elección aplicados a política ambiental para identificar las causas potenciales del efecto SQ. Los resultados muestran que la incorporación de la heterogeneidad en el análisis econométrico, la exclusión de respuestas protesta y la disminución del esfuerzo cognitivo asociado a la elección reducen la presencia del efecto SQ.

PALABRAS CLAVE: Meta-análisis, experimentos de elección, efecto *status quo* en la valoracion del medioambiente.

JEL classification/Clasificación JEL: C25, Q51.

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1. Introduction

In the last two decades, there has been a growing interest in applying Discrete Choice Experiments (DCE) to inform decision-making processes related to environmental policies. DCE are based on the idea that a good or service can be described as a combination of several attributes with varying levels. Respondents choose among different alternatives of attributes and levels, so that they implicitly value each attribute. This allows the estimation of welfare measures by statistical inference. The main advantage of DCE is its capacity to deal with multi-attribute questions and to allow for trade-off analysis (Hoyos, 2010).

In most DCE applications, individuals make choices among different scenarios or options, which might include one reflecting the *status quo* (SQ). The SQ reflects a scenario where no action is taken, which is compared to alternative scenarios where policy interventions or lack thereof lead to improvements or degradations. The "SQ bias" or "SQ effect" (SQE) occurs when individuals disproportionally choose the SQ (Adamowicz *et al.,* 1998).

As Masatlioglu and Ok (2005) have proposed, standard choice theory would be a special case of rational choice if you "introduce the possibility that individuals may have an initial reference point capturing a default option, current choice and/or an endowment" (pg. 21). Whether SQE is a positive or negative characteristic for DCE valuation is beyond the scope of this paper. SQE can signal perfect rational behaviour if interviewees do not find a preferred option among those proposed either because of zero or close to zero value in demand side applications or very high willingness to accept in supply side ones. It can also be seen as an economic consistent behaviour resulting from of rational decision making in the presence of uncertainty; cognitive misperceptions or endowment effects (Samuelsson and Zeckhauser, 1988; Kahneman and Knetsch, 1992). Focusing on DCE Boxall *et al.* (2009) put forward three reasons why people choose the SQ: endowment effect, omission bias and avoidance of choice. Endowment effect would imply that the SQ has a specific utility irrespective of its attributes, which would put into doubt all welfare economics (Just, 2017). Omission and avoidance of choice relate to respondents seeing the SQ as their preferred option or as a default. The former is the rational case mentioned above while the latter highlights a preference for inaction or non-participation. Preference for inaction can be related to the complexity of the choice design, fear of regret and responsibility associated with poor outcomes (Boxall *et al.*, 2009).

Non-participation can reflect both a preferred option or a protest behaviour. There has been quite some research on the impact of protest responses on DCE. Protest responses can be characterized as those taken by people that instead of participating in the hypothetical market reject it. In DCE this will lead to serial non-participation (i.e. systematic choice of the SQ if it involved no payment). The identification of protest responses needs to consider what distinguishes them from true zeros in demand side DCE (Meyerhoff *et al.,* 2012) or very high takers for supply side DCE (Villanueva *et al.,* 2017). Research has found that protest behaviour that has not been considered

in the analysis can lead to significant differences in both SQE and welfare estimates (Brouwer and Martin-Ortega, 2012; Villanueva *et al*., 2017).

Scarpa *et al*. (2007) claim that SQE is just reflecting the fact that the SQ is a real choice while the alternatives are hypothetical: a significant coefficient for the SQ option just confirms that "there is a difference in perception and substitutability between experimentally designed alternatives and the status quo" (pg. 460). On the other hand, it can show that the analyst has not identified the most relevant attributes for the goods or services being valued, therefore implying that the random component of utility being modelled in Random Utility Models (i.e. the one not observed by the analyst) is significant and the analyst has not identified all the drivers of choice. The relative weight of the myriad of potential theoretical justifications for the presence of SQE has been approximated from economic, psychology and decision-making theory angles. In our paper we can identify via proxies how much some of these reasons matter, however we cannot discard the importance of those aspects we cannot identify in our research strategy (i.e. data not reported in the papers used for the meta-analysis). For example, with regards to preference for inaction as a driver of SQE we can obtain information about choice design complexity but cannot tackle the measurement of fear and regret; and for the issue of protest behaviour we can tackle the issue indirectly by including a specific variable that considers how protest bidders have been treated in the studies considered. In our research we do not deal with the identification of reasons for protest behaviour, an issue already tackled in other meta-analyses (Meyerhof and Liebe, 2010; Meyerhof *et al*., 2014).

SQE is a common aspect referred to in papers applying DCE. During the literature search used in this paper (see below) close to 10 % of all papers that showed up included the term "status quo effect" or "status quo bias". However, the literature on this specific topic is rather scarce. Scarpa *et al.* (2005) recommend that a status quo option is included in the choice card design and an alternative specific constant as a variable in the modelling to avoid bias. In their comprehensive study on the topic, Oehlmann *et al.* (2017) try to uncover the drivers of SQE in choice experiments. Based on a set of DCE applications which vary the number of choices, alternatives, attributes and levels as well as the level range, the authors found that the frequency of status quo choices is negatively associated with the number of alternatives and positively related to the number of choice tasks that the respondents face and the level range. However, this study consists in a specific application fully controlled by the analyst and therefore focusing on the design of DCE, so that they do not reflect other drivers of SQE in the existing empirical DCEs (e.g. survey implementation, model specification, etc.).

Our paper contributes to the understanding of SQE in DCE applications from a complementary perspective. Instead of varying DCE characteristics applied to a common sample, we take advantage of the growing literature using DCE to conduct a meta-analysis to identify the potential drivers of SQE in DCEs applied to the valuation of environmental good and services. In this research, we focus on the presence or absence of SQE in economic valuations that apply the method of the choice experiments to environmental policy contexts. The binary nature of our research question

does not allow us to quantify a cardinal effect-size, but the estimation of the probability that SQE is present given certain features of the DCE and survey design.

The rest of the paper is structured as follows. First, we present the approach used for the analysis describing the data selection process and the classification procedure applied to the studies included in this meta-analysis. We then describe the main characteristics of the studies reviewed focusing on the main characteristics that a priori could affect the presence or not of SQE, including how the variable of interest was assessed. The results section focuses on both bi-variate and multi-variate modelling analysis of the relationship between the identified characteristics and the presence or not of a status quo effect. The next section discusses the main results while the last section presents recommendations to practitioners to reduce the risk of SQE, highlights the limitations of our research together with avenues for future research to better understand the role of status quo effects in DCE applications.

2. Material and methods

2.1 Meta-analysis as a research tool

Meta-analysis was first proposed by Glass (1976) as a method for the systematic quantitative summary of evidence across empirical studies on a given hypothesis, phenomenon, or effect. It seeks to combine estimates from different primary studies and to explain the reasons behind the variation in their results and findings. It has been widely used in several fields, including environmental sciences, health sciences, psychology and social sciences. Quantitative meta-analysis relies on meta-regressions in which the dependent variable is a common summary statistic or "effect-size" that is described as function of a set of explanatory variables (Stanley *et al.,* 2013). For example, a common application of meta-analysis in the field of environmental economics is "benefit transfer", which consists in producing predicted values (e.g. willingness to pay values) for out-of-sample forecasts of effect-sizes for another location or environmental asset (Nelson and Kennedy, 2009). However, a meta-analysis may not yield specific effect-sizes when the dependent variable describing such an effect is not purely quantitative. Therefore, the econometric approach appropriate for a meta-analysis depends on the nature and quality of the data available for the analysis and on assumptions regarding the data collection. For instance, Rakotonarivo *et al.* (2016) analyse the reliability and validity of choice experiments for the valuation of non-market environmental goods. The authors describe the state of evidence by highlighting the number of studies providing a yes or no answer to a set of questions of interest. For our research, we adopt a similar approach in which the presence of SQE captured by a DCE application is described as a dichotomy state (i.e. yes or no). In addition, choice experiment applications are too heterogeneous in terms of context and design to permit a fully quantitative meta-analysis of SQE.

2.2. Objective and sample selection

The objective of our meta-analysis is to gain information on the determinants of SQE in environmental valuation exercises using discrete choice experiments. To select the studies to be reviewed, we conducted a systematic literature review of peer-reviewed papers included in the "Web of Science™ Core Collection" (WoK). The universe of studies corresponds to the total results displayed by the WoK entering the unique keyword "choice experiment" and selecting the field "Topic"[1]. This search resulted in 3,440 hits. An initial sample of 100 papers was allocated by year proportionally to the total number of hits in a given year[2]. The total number of hits per year is reported by the WoK in the field "Publication Years". Then the authors screened the list of publications from highest relevance to lowest until they found enough papers to meet the sample quota for the year. For this purpose, the authors used the "Relevance" criterion which is available in the display menu of the WoK site. The screening was focused on the valuation of environmental policies, so that studies involving purchasing goods such as those dealing with consumer's preferences towards organic food or environmental standards (e.g. ecolabel) were excluded. Also, as the focus is to better understand SQE, studies that did not include a SQ option in the choice set design were also excluded. This search was done on 21st May 2017. Annex I contains the full list of papers.

Following the procedure above and given the fact that for some years not sufficient papers meeting the selection criteria were identified, we reached a final sample size of 95 papers. Figure 1 shows the number of papers per year from our initial search in the WoK.

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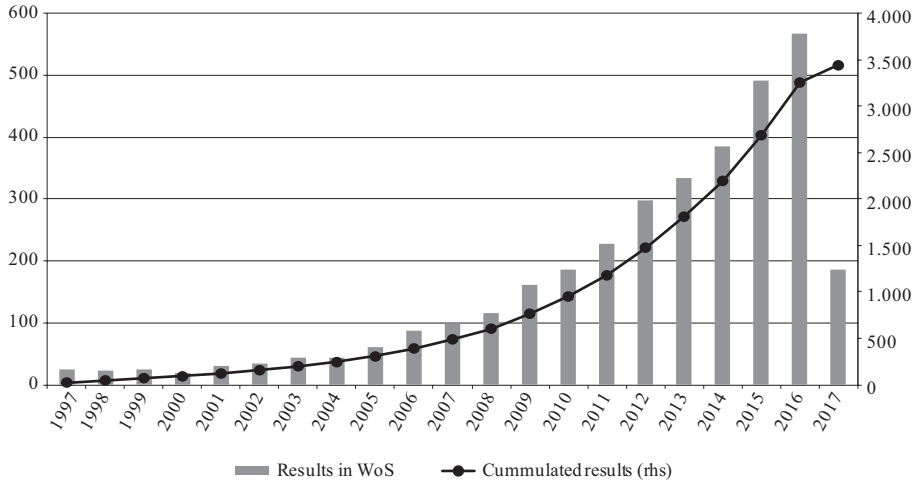
[1] As noted by one reviewer, using as search criteria "choice experiment" is a reductionist approach as "choice modelling" and "choice modeling" are also used to describe DCE. To identify the impact of this reductionist approach we conducted searches with the same parameters as that undertaken for "choice experiment" with these two alternatives and identified 931 additional papers, approximately 30 % of our universe with the relative importance of this additional nomenclature shows a decreasing trend with time. We cannot predict whether drawing our sample from a universe that includes these additional papers would have an impact on our results.

[2] Sample size in meta-analysis is driven by the feasibility of the study (Pigott, 2012). In fact, the minimum level of studies for a meta-analysis is two, being nine the lowest number of studies recommended in the literature (Valentine *et al*., 2010). As these references highlight, when undertaking a meta-analysis an adequate selection and justification of the studies is more important than providing a specific sample size.

FIGURE 1

Number of papers appearing in WoK using the keyword "choice experiment"



Source: Web of Science™ Core Collection.

2.3. Database coding and variable selection

Each of the papers included in the sample was read by two of the authors which filled in a pre-defined database template covering all the variables mentioned below. When divergences were detected between the coding of any variable for a given observation[3] a third author checked the paper for the relevant information and selected the right coding.

Our variable of interest is the one that reflects whether a significant SQE is present in each of the studies. For this we focus on the coefficient reported for the so-called Alternative Specific Constant (ASC). Researchers usually include an ASC in the econometric estimation in order to account for factors that impact respondents' utility function, but that are not represented by the attributes and levels of the different choice occasions. Thus, a significant ASC might imply that SQE occurs (Meyerhoff and Liebe, 2009). The ASC reflects the (des)utility associated to the SQ and is usually codified as a dummy variable that equals one when the SQ option is chosen by the respondent and zero otherwise. A positive and significant ASC indicates that the individuals perceive the utility associated with keeping the current situation as positive. In short, respondents, all other things constant, are reluctant to move away from the SQ. Alternatively, ASC can be codified as a dummy variable that equals

[3] Observation might refer to paper, application or model. See below for further clarification.

one when the alternative options are chosen. In such a case, the positive and significant value of the ASC means that moving away from the current situation increases respondents' utility.

We codified SQE as a dummy variable that takes the value one if the coefficient of the ASC is positive (negative) and significant ($\alpha < 0.05$) when the ASC is defined as one if the SQ (any of the other alternatives) is chosen. We consider no SQE if the ASC is non-significant or is significant and has a negative (positive) when the ASC is defined as one if the SQ (any of the other alternatives) is chosen. While for demand side DCE a negative (positive) ASC value might be signalling a yeah-saying behaviour, another well-known problem of hypothetical valuation exercises implying that some respondents always choose alternatives independent of the attributes (including bid amount) presented to them (Boyle, 2003). This effect is different to SQE and therefore is beyond the scope of this meta-analysis.

In addition to the SQ variable, we collected information on four aspects of the reported DCE that might influence the presence of SQE: (i) DCE design, (ii) survey implementation, (iii) scenario definition and (iv) econometric analysis. As we have not identified any prior literature reflecting on which characteristics could influence SQE, the database constructed tries to cover any relevant facet of the four aspects mentioned above. In this manner the analysis will both help understanding SQE and providing guidance for future meta-analysis on the subject.

Table 1 summarizes the main variables that were systematically revised and codified in the database and contrasted against the presence of SQE. In the following, we briefly define each of them. The variables in the *DCE design* category correspond to the essential features of any choice experiment: number of attributes used to design the options, number of levels used to describe the attributes, number of alternatives presented to the individuals in each choice option and number of choices each individual makes during the valuation exercise. The final configuration of the DCE is also determined by two other elements: (i) whether the selection of attributes and levels is the result of focus groups or expert consultation, and (ii) the design used to construct the choice sets (e.g. orthogonal main effects, efficient design).

The variables in the *Survey implementation* category focus on how the DCE was undertaken. Here we focus on the delivery mode for the interviews distinguishing between face-to-face, postal, phone or web based. We also record whether interviews were rewarded for their participation in the survey, the number of people interviewed, how long did the average interview take, and the geographical location where it was delivered. Last, we also recorded whether the target population of the valuation was the general public or a specific group such as visitors to natural areas (i.e. Christie *et al.,* 2015), farmers (i.e. Espinosa-Goded *et al.,* 2010) or fishermen (i.e. Kanchanaroek *et al.,* 2013).

The variables in the *scenario definition* category focus on how researchers describe and simulate the hypothetical market. Within this category we include a variable capturing whether the environmental change valued is responsibility of the population that is being surveyed (i.e. change in water management by residents in a water basin as in Glenk *et al.,* 2011) or a third party (i.e. changes in design of power lines

by electricity company as in Tempesta *et al.,* 2014). In this category we also consider who sets the levels of the attributes for the SQ. Here one can distinguish between studies where the SQ is described by specific levels of the same attributes that describe the alternatives and those where the individual sets his own status quo. The latter can be described by DCE where either by choosing an option described as "I prefer none of the [two] alternatives" (Hope *et al.,* 2008) or where the levels of the attributes in the SQ are set by the individuals behaviour (Espinosa-Goded *et al.,* 2010). We also record whether the SQ alternative is a combination of the worst levels of all attributes (i.e. the alternatives represent an improvement). Other aspects recorded in the database include whether the study elicits willingness-to-pay or willingness-to-accept, whether the scenario measures demand for environmental goods or supply, the payment vehicle which is used in the valuation, whether the payment is on-off or recurrent, and the kind of policy analysed with regards to its objective (water, energy, agriculture, etc.).

Last, we include a set of variables specifically related to the econometric specification used for the analysis of the DCE including the type of econometrical method (multinomial logit model, mixed logit model with or without error component specification, latent class models or others) and whether and how many variables are included in the model interacting with the ASC. The explicit exclusion of protest responses before the econometrical estimation is also considered as it may minimize the presence of SQE.

As the sampling units in the meta-analysis are papers, the analyst has to deal with the fact that each paper might report more than one DCE result. The multiple DCE results can relate to different applications (i.e. different scenario designs) or different models (i.e. different econometric analysis). For the latter case, the analyst finds several observations per paper which have common values for variables for the first three domains and differ only on the econometric specification. In some cases, the DCE results reported in one paper differ in their outcomes regarding the ASC[4]. For example, based on the same DCE design, survey and dataset, a multinomial logit regression may indicate SQE, whereas a mixed logit regression may not, and vice versa. To take into account this when undertaking the bivariate analysis, we need to decide how to select the value of the SQ variable when working with multiple observations for the same paper. To avoid any bias towards or against SQE when analysing the effect of variables capturing the modelling invariant characteristics have undertaken coding SQE following two approaches. If the study presents contradicting information about SQE (i.e. the sign of the ASC is negative in one econometric specification and positive in another one), the first coding approach assumes observed SQE, whereas the second coding approach consider non-observed SQE. The multivariate analysis exploits the full dataset using binary variables representing the econometric model specification as control variables in a logit regression model.

[4] For example, in Börger *et al.* (2014) results are presented for three econometric specifications (a MNL, an attribute only MXL and a MXL with interaction of socio-demographic variables with the ASC). The first one showed a significant status quo effect while the other two did not.

TABLE 1

List of aspects considered in the database construction

Domain	Aspect	Variable Type
DCE design	Number of attributes	Cardinal
	Number of levels (absolute and per attribute)	Cardinal
	Number of alternatives per choice card (including SQ)	Cardinal
	Number of choices per individual	Cardinal
	Type of fractional design	Categorical
	Design informed by focus groups	Binary
Survey implementation	Survey mode	Categorical
	Premium for participation	Binary
	Sample size	Cardinal
	Interview duration	Cardinal
	Country	Categorical
	Type of target population	Binary
Scenario definition	Responsible of the environmental change	Binary
	Status quo definition by researcher or by individual	Binary
	Status quo as worst possible scenario	Binary
	Willingness to pay / accept	Binary
	Supply / Demand	Binary
	Payment vehicle	Categorical
	Payment recurrence	Binary
	Type of policy	Categorical
Econometric analysis	Protest responses treatment	Binary
	Interactions with ASC	Cardinal
	Model specification	Categorical

Source: Own elaboration.

2.4. Statistical analysis

Three different types of analysis have been made using the meta-analysis dataset. First, we present univariate statistics. For these analyses when dealing with DCE design, survey implementation and scenario definition, we use as unit of analysis the application (95 observations) and, when dealing with econometric analysis, the individual model (194 observations). Second, we report bivariate analysis (chi-square) for dichotomous or categorical variables using the application as unit of analysis and the two different coding approaches specified in the section above. Last, we run a multivariate logit model (Greene, 2011) aiming to explain the relationship between

the dependent binary variable (SQE) and the other explanatory variables collected from the different primary studies. The multivariate logit model was done combining independent variables from all domains using the full data sample and considering the model as unit of analysis.

We also tried to run regressions using for each application both the characteristics of a model that had SQE and of one that did not. As we found that results vary depending on the specific application chosen to define whether there is SQE, initially we tried to include all variables into an application specific estimation framework. However, this raised econometric problems as there is correlation between variable categories. In particular we found that the explanatory variables related to context of the application (i.e. type of policy assessed; location of the study) and to application design (i.e. number of attributes; number of levels) were correlated and therefore the impact cannot be clearly identified. In order to capture both econometric and study specific analysis, we finally opt for performing two different regressions. While this further complicated concluding causality, we believe it adds additional insights into the SQE debate.

The estimation strategy starts with the inclusion of all the variables described in Table 1. Non-significant variables were excluded one by one checking for model improvement until the reported models were selected based on model diagnostic indicators.

3. Results

Our sampling strategy results in 95 papers revised in which we have identified 103 DCE applications and 194 different econometric models.

3.1. Univariate statistics

Before analysing the determinants of SQE, we present the main descriptive statistics of the variables gathering in the database. Table 2 reports the main statistics related to the main features of the DCE design. The most common DCE design contains five attributes (including the monetary attribute) and 17 levels (3.6 levels per attribute in average), which are usually grouped in 3 alternatives (including the SQ alternative). Each respondent faces about 5 choice cards during the interview. In average, the participants usually need about 20 minutes to finalize the valuation exercise.

Table 3 and 4 report the descriptive statistics of the binary and categorical variables collected. The use of focus groups or expert consultation to gather information for the CE design is explicitly mentioned in 88.3 % of the studies. Only 3.9 % of the studies included a premium for participation to interviewed individuals. The general public is the most frequent type of target population (70 %), while 30 % belongs to specific sectors. The target population is the direct responsible of the environmental change in the 36.9 % of the revised studies. The researcher usually explicitly describes the SQ scenario (68.0 %), which represents the worst situation in 38.8 % of

the cases. DCE studies usually apply a willingness to pay approach (84.4 %) and a demand perspective in the simulation of the hypothetical market (83.5 %) being the payment recurrent (74.5 %). The most frequent payment vehicles are taxes (41.7 %), tariffs (18.8 %) and subsidies (12.5 %), while the policies that are mainly analysed are those related to natural ecosystem management (43.7 %), water policy (22.3 %) and agricultural policy (19.4 %). Regarding the survey mode, 69.9 % of the studies collected data via face-to-face interviews, 16.5 % via Internet and 13.6 % via postal mail.

TABLE 2

Descriptive statistics of continuous DCE characteristics of reviewed applications

CE design	Mean	Mode	Min.	Max.
Number of attributes	4.8	5	3	13
Number of levels (absolute)	17.1	14	7	91
Number of levels per attribute	3.6	3	1.8	7
Number of levels of monetary attribute	5.3	4	0	11
Number of alternatives per choice card (including SQ)	3.0	3	2	5
Number of choices per individual	6.1	6	3	12
Interview duration (minutes)	21.7	20	-	42

Source: Own elaboration based on reviewed DCEs.

TABLE 3

Descriptive statistics of dichotomous DCE characteristics of reviewed applications

Variable	Percentage
Design informed by focus groups	88.3
Premium for participation	3.9
Type of target population (General public)	70.0
Target population responsible of the environmental change	36.9
Status quo definition by analyst	68.0
Status quo as worst possible scenario	38.8
Willingness to pay approach	84.4
Demand perspective	83.5
Payment recurrence (more than once)	74.5
Protest responses excluded form analysis	35.0

Source: Own elaboration based on reviewed DCEs.

TABLE 4

Descriptive statistics of categorical DCE characteristics of the reviewed applications

Variable/Category	Percentage
Type of fractional design	
Orthogonal main effects	45.6
Efficient	49.5
Others	4.9
Payment Vehicle	
Taxes	41.6
Rate	9.4
Contribution to NGO	4.2
Tariffs	18.8
Subsidies	12.5
Preservation fund	3.1
Food	1.0
Via prices	9.4
Survey mode	
Face to face	69.9
Web based (Internet)	16.5
Postal mail	13.6
Policy type	
Natural Ecosystem Management	43.8
Water Policy	22.3
Energy Policy	5.8
Climate Change	1.9
Agricultural Policy	19.4
Waste Treatment	1.0
Forestry	1.9
Air quality	3.9
Econometric specification	
Multinomial logit	37.6
Mixed logit	39.2
Mixed logit - Error Component Specification	4.6
Latent Class	12.9
Others	5.7

Source: Own elaboration based on reviewed DCEs.

Efficient design of DCE is applied in 49.5 % of the studies, while 45.6 % are based on orthogonal main effects and 4.9 % in other methods (e.g. balance overlap design). Protest responses are explicitly analysed and eliminated in 35 % of the studies. Multinomial logit model (37.6 %) and mixed logit models (39.2 %) are the econometrical methods most frequently applied in the analysis of DCE.

Regarding our variable of interest, SQE was detected in 56 of the 194 models in the sample (28.9 %). The remaining 136 were split between those reporting a significant non-SQE [116 (59.8 %)] and those reporting a non-significant ASC [22 (11.3 %)].

3.2. Bivariate analysis

Table 5 shows the results of Chi-Square tests to contrast the relationship between SQE and the econometric specification, while Table 6 summarizes the results of the significant contrasts between SQE and those variables related DCE design, survey implementation and scenario definition. For the latter, we used the two-ways coding specified in section "2.3 Database coding and variable selection". Results show that multinomial and mixed logit models yield opposite results with regard to SQE. The multinomial logit model seems to be more sensitive to SQE when inferring individuals' utility from dichotomous choices than the mixed logit model.

TABLE 5

Results of the bivariate analysis between SQE and econometric specification variables

Econometrical specification	χ^2	p-value	Effect on SQ
Multinomial logit	5.134	0.023	Positive
Mixed logit	6.639	0.010	Negative
Mixed logit - Error Component Specification	1.449	0.229	n.s.
Latent Class	1.732	0.188	n.s.
Others	1.449	0.229	n.s.

N = 194 model reported / n.s. = not significant.
Positive means that the variable contributes to SQE presence; otherwise, it is specified as negative.
Source: Own elaboration.

The bivariate analysis for the SQ determinants shows that SQE presents positive correlation with the use of orthogonal design and negative correlation with efficient designs. When in the hypothetical scenario the SQ is presented as the worst situation, it may lead to lower probability of SQE. Scenarios based on willingness to pay and demand analysis induce higher SQE presence, whereas the use of subsidy as payment vehicle presents the opposite. When the researcher defines the SQ alternative by specifically describing attributes and levels, the respondents may act with a higher

SQ bias. Moreover, when the study considers the target population as the main agent who bears the effort of the change from the SQ, the respondents may also act with higher SQ bias. Finally, studies dealing with agricultural policies may present higher SQE, while DCE surveys implemented in southern Europe yield opposite effects.

TABLE 6

Results of the bivariate analysis between SQE and DCE design, survey implementation and scenario definition variables

Variable	Coding approach A (SQE present if any model has SQE)			Coding approach B (SQE present if all models has SQE)		
	χ^2	p-value	Effect on SQ	χ^2	p-value	Effect on SQ
Orthogonal design	4.906	0.027	Positive	4.777	0.029	Positive
Efficient design	2.541	0.111	n.s.	3.446	0.063	Negative
SQ is worst scenario	1.648	0.199	n.s.	4.373	0.037	Negative
WTP approach	6.536	0.011	Positive	2.603	0.107	n.s.
Demand perspective	6.488	0.011	Positive	2.667	0.103	n.s.
SQ definition by researcher	3.332	0.068	Positive	0.301	0.584	n.s.
Payment vehicle - subsidy	3.373	0.066	Negative	1.223	0.269	n.s.
Responsible target population	7.020	0.008	Positive	2.702	0.100	n.s.
Agricultural policy/other policies	7.247	0.007	Positive	5.051	0.024	Positive
South Europe/other regions	1.929	0.166	n.s.	3.010	0.083	Negative

N =103 applications reported / n.s. = not significant.
Positive means that the variable contributes to SQE presence; otherwise, it is specified as negative.
Source: Own elaboration.

3.3. Multivariate analysis

Following the descriptive and bivariate analysis reported above, this section presents the results of logit regressions attempting to identify the characteristics of DCE design or modelling approaches that have an impact on the presence of SQE. The dependent variable takes a value of one if in the assessment of the application we identified a positive preference for the SQ and zero when not. For all reported models, variance inflation factors (VIF) analysis shows that there is no collinearity between the independent variables considered. Moreover, while we report full results with non-significant variables, the exclusion of these variables does not affect the sign or significance level of the rest of the variables.

We start the presentation of results focusing on the model that includes context variables (i.e. type of good, etc.). The final model is presented in Table 7. The model correctly predicts 77.3 % of all cases and has an overall significance over 99 % when

compared to a naïve model which allows us to conclude that it has a reasonably good fit. As expected, the results confirm those obtained in the bivariate analysis: the probability of having SQE in the model results decreases when the modelling approach takes into account the heterogeneity in preferences. This can be seen by the negative sign of the coefficients for the mixed logit and error component variables when compared to the base case of using a conditional multinomial logit model, which assumes equal preferences for all individuals. This is not the case for model specifications considering lumpy heterogeneity (Hynes *et al.,* 2008) as the coefficient for latent class is not significant.

TABLE 7

Results for the SQ regression – context variables

Variable	Coefficient	St. Dev.	Z statistics	P value	Marginal Effects
Mixed Logit	-0.997	0.400	-2.493	0.013**	-0.177
Latent Class	-0.394	0.520	-0.756	0.445	-0.069
Error Component	-2.110	1.157	-1.823	0.068*	-0.227
Others models	-0.980	0.772	-1.269	0.205	-0.144
Supply side scenarios	-0.644	0.266	-2.420	0.016**	-0.134
Responsible target population	0.598	0.361	1.656	0.098*	0.118
Agricultural policy related	0.947	0.455	2.083	0.037**	0.201
Study in Southern Europe	-1.158	0.480	-2.412	0.016**	-0.189
Summary statistics	N: 194 Correct predictions 77.3 % Log-likelihood ratio: 37.71 – Significance level $\chi^2_{(8\ D.f.)}$: 0.000				

Source: Own elaboration.

Focusing on application specific variables, when the application focuses on supply-side scenarios (i.e. the valuation is based on paying agents to perform some kind of behavioural change), there is a higher probability that respondents will choose any of the options rather than the SQ. When the target population has to undertake a change in their behaviour to reach the environmental improvement, there is reluctance to choose the alternatives to the SQ. The last two variables that affect the probability of having SQE in a DCE application relate to the topic of the valuation and the location of the case study. When the valuation exercise relates to agricultural policy there is a higher probability that one will find SQE. Regarding the geographical context, applications carried out in Southern Europe have on average less SQE. If we focus on the marginal effects, the biggest impacts on reducing SQE are associated with the econometric specification, followed by the design of the scenario in terms of willingness-to-accept and last the geographical location of the study.

The model that includes design and implementation aspects as explanatory variables is presented in Table 8. The model correctly predicts 72.7 % of all cases and has an overall significance over 99 % when compared to a naïve model which allows us to conclude that it has a reasonably good fit. However, this model slightly underperforms when compared to that focusing on context variables shown above. The results for econometric specification variables are similar to those reported for the other model. Here the incorporation of heterogeneity into the econometric specification also significantly reduces the probability of having SQE. However, in this model there is no added value of using more complicated models such as the error component to reduce SQE.

TABLE 8

Results for the SQ regression – design and implementation variables

Variable	Coefficient	St. Dev.	Z statistics	P value	Marginal Effects
Mixed Logit	-1.097	0.396	-2.769	0.006***	-0.198
Latent Class	-0.375	0.511	-0.734	0.463	-0.067
Error Component	1.431	1.163	-1.231	0.218	0.191
Others models	-0.898	0.773	-1.161	0.245	-0.140
Exclusion of protest response	-0.755	0.389	-1.940	0.052*	-0.137
Efficient design	-0.309	0.363	-0.850	0.395	-0.059
Number of attributes	0.354	0.176	2.016	0.044**	0. 068
Number of levels	-0.112	0.051	-2.198	0.028**	-0.022
SQ defined by individual	0.596	0.387	1.539	0.124	0.120
Summary statistics	N: 194 Correct predictions 72.7 % Log-likelihood ratio: 25.3– Significance level $\chi^2_{(9\ D.f.)}$: 0.003				

Source: Own elaboration.

We find that the exclusion of protest responses from the analysis reduces the probability of obtaining significant preferences for the SQ in the analysis of DCE. This was expected as researchers applying DCE usually eliminate those individuals that systematically present protest behaviour and/or select the SQ option systematically when facing the different choice occasions, which reduces the share of SQ-related options within the analysed sample. Moreover, the results show that reducing SQE is also related to the quantitative dimension of the choice experiment design, i.e., the selection of attributes and levels. The more attributes the analyst includes in the DCE, the higher the probability of having SQE. However, increasing the total number of levels decreases the probability of SQE. Contrary to the results obtained in the bivariate analysis, the model does not detect a significant impact of the type of design

used to construct the choice cards on the probability of having SQE (i.e. efficient designs *vs.* other approaches), so that our results are not clearly conclusive regarding the effect of the type of design used to construct the choice cards. Last, whether the status quo is defined by the analyst or varies depending on the specific characteristics or believes of the individuals does not impact the probability of having SQE.

4. Discussion

The results of the meta-analysis show that higher individuals' preferences towards the SQ can be induced by both contextual and experimental features accompanying DCE applications. The former relates to how individuals act in the hypothetical market represented by the DCE (e.g. strategic bias, protest behaviour) as well as the framework of the evaluation (e.g. policy target, geographical location). Within the experimental features, we find that several stages of the DCE application from the design to the analysis may influence the presence of SQ bias.

The meta-regression shows that SQE is positively correlated to valuations where the target population is responsible for the change and negatively related to valuations that take a supply-side approach. These two variables taken together show some support to a property rights impact on SQE. If the sample is the owner of the SQ and the application focuses on valuing how much is needed for making changes in behaviour, individuals accept trade-offs better and thus do not systematically choose the SQ situation. On the other hand, if the scenario design implies that changes from SQ have to impose changes in their behaviour without explicitly compensating (i.e. they are not the owners of the property rights assigned to the SQ), there is a systematic preference for not moving away from it.

The results also show that there is some systemic reluctance of individuals to pay for changes in supply of environmental goods coming from agriculture irrespective of the public goods or levels provided, something that could be related to the idea that there is a conflict on visions of how property rights of such goods are distributed. This would be related to the endowment effect mentioned by Boxall *et al*. (2009). This is even more evident when one considers that many of the applications reviewed focusing on agricultural policy evaluation look at supply side evaluations, which are associated with no SQE. Regarding the geographical context, applications carried out in Southern Europe have on average less SQE. Surprisingly enough, this would go against a budgetary constraint explanation of the SQE as income in Southern Europe is lower than many of the other regions considered, and lower incomes would be related with less choice of options that imply additional expenditure.

Regarding the building blocks of DCE design, i.e. number of attributes, number of levels and number of alternatives in the choice set, our results stand at odds with those reported by Oehlmann *et al*. (2017). While they conclude that SQ choices are not affected by the number of attributes, our meta-regression indicates that there is a positive and significant correlation between the number of attributes and the probability of SQE. Moreover, the number of levels shows a negative sign in this meta-analysis while Oehlmann *et al*. (2017) report the contrary. Last, we do not find a sig-

nificant effect of the number of alternatives per choice or the number of choices that respondents face. The latter might be driven by the fact that there is a high prevalence of the SQ plus two alternatives in our sample (90 % of our sample uses this option). However, with regards to cognitive burden our results seem to point out towards a trade-off between preference matching (decreasing SQE by providing more alternatives in each choice card) and cognitive burden (more alternatives make choice more difficult) of choosing the number of alternatives to minimize SQE. For the other two variables, in line with Oehlmann *et al*. (2017), we would recommend practitioners who want to reduce the risk of SQE to reduce the number of choice tasks per individual and keep the level range within the expected uncertainty. However, the number of levels, within the plausible range, should be increased.

We find that the explicit definition of the SQ attribute levels do not affect the probability of reporting SQE. This result contradicts the findings reported by Marsh *et al*. (2011), which is one of the few papers that have tested the influence of scenario definition on SQE. The results of their DCE application suggest that participants who referred to their own SQ description had a higher preference towards the SQ, whereas participants individuals facing a predefined SQ tended to prefer the improvements proposed by the analysts. They argue that this might be a kind of reluctance to leave what one believes s/he knows well.

In line with Bonnichsen and Ladenburg (2015), we find that exclusion of protest responses from the analysis reduces the probability of SQE. These authors show how reducing protest rates via cheap talk can reduce SQE. Moreover, it makes sense that SQE relates to protest behaviour as these responses normally show choice patterns that systematically prefer the SQ irrespective of any scenario characteristics (Rodríguez-Entrena *et al.,* 2014). However, even after excluding protest responses, SQE can persist when there are conflicting interests between different stakeholders (Perni and Martínez-Paz, 2017).

Other analytical aspect that may influence SQE is the econometrical specification. As reported in the previous sections, results show that multinomial and mixed logit models present opposite correlations with respect to the SQE. In general, it seems that mixed logit model trend to minimize SQE presence. The main difference between both models is that the mixed logit accounts for heterogeneity in individual preferences by relaxing the assumption of independence of irrelevant alternatives inherent to the multinomial logit model, and it may lead to a minimization of the impact of individuals' SQ bias in the overall model estimation.

Last, DCE evaluations are relevant for policy makers in order to obtain unbiased welfare measures. The welfare estimates depend on the propensity to choose SQ alternative, and therefore it is related with SQE. The study by Oehlmann *et al*. (2017) highlights that differences in the design of the CE have significant influence on marginal as well as non-marginal welfare estimates. In addition, in the literature there is a debate on whether to include or not the ASC in the calculation of marginal welfare measures as the welfare estimates are significantly different (Boxall, 2009; Oehlmann, 2017). In any case, it is recommended to reduce the value of the ASC that it is not due to the respondent legitimate choice (respondents making trade-offs

among alternatives considering all the attributes). This will mean reducing SQE and therefore having a more accurate welfare measure.

5. Conclusions

In this paper we have conducted a meta-analysis of DCE applications to value environmental goods and services to investigate the potential drivers behind the status quo effect. Based on 95 papers reporting 103 applications and 194 model results, we have conducted univariate, bivariate and multivariate analysis related to the presence or not of SQE defined as a significant alternative specific constant reflecting systematic preference of the SQ option within the choice occasions.

Regarding the theoretical reasons that have been put forward as driving SQE, we can conclude that in many cases SQE is not the result of a perfectly rational behaviour. Our review provides some support to SQE being the result of a lack of treatment of protest responses. Moreover, SQE seems to be also the result of avoidance of choice due to complexity. Our research approach does not allow us to identify whether fear of regret might be also behind SQE identified, as this is best tackled at individual study level due to the amount of information needed to identify such a behaviour.

We believe that the results of the paper can help practitioners to better design their experiments to minimize SQE. We have shown that the probability of SQE may be reflecting not only individual preferences, but can be the result of protest behaviour, DCE design choices, survey implementation, scenario definition and econometric analysis. While some factors are not within the control of the analyst (i.e. type of policy being evaluated or location), others are. From our results we can provide a series of recommendations for researchers aiming at valuing environmental goods and services to minimize SQE not related to rational behaviour. First, researchers should exclude protest responses. Second, cognitive burden associated with the choice task should be minimized by reducing the number of attributes used and increasing variability with more levels for each attribute. From an econometric perspective, researchers should use models that incorporate heterogeneity into the analysis (Mixed Logit, Latent Class, etc.). A rigorous control of the different SQE determinants will reduce potential bias in the estimation of quantitative economic indicators and welfare estimates (e.g. utility, willingness to pay, consumer surplus).

Our analysis shows some limitations that need to be highlighted to make the result more useful. Some relate to the methodological approach itself and others to the understanding of SQE. As far as the methodological approach is concerned, the meta-analysis is as good as the reported data in the studies used. Some of the characteristics tested in an ad-hoc study such as that of Oehlmann *et al.* (2017) cannot be extracted from revising other papers (e.g. entropy measures of similarity between alternatives in a choice task). However, combining both approaches can provide relevant insights as discussed above. Another limitation is the lack of an intensity measure of SQE that can be calculated with the data reported in published studies. This would allow understanding the drivers of SQE magnitude and not simply what drives it. While Bonnichsen and Ladenburg (2015) use the WTP for the SQ option

as an indicator of magnitude, it is not clear that this can be used across applications. Additional research on this SQE cardinal indicator is needed.

Finally, as a by-product of our meta-analysis, we would like to recommend DCE practitioners to report as clearly as possible all the variables presented in Table 1. Recovering this information has proven a daunting challenge even for a reduced sample as the one used here. Particularly hard information to retrieve is that related to treatment of protest responses, payment vehicle, frequency of payment and interview duration. Moreover, even in some cases just discovering sample sizes and choices per individual has proven a hard task.

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Annex I – List of papers included in the review

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