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Do status quo choices reflect preferences? Evidence from a discrete choice experiment in the context of water utilities' investment planning*

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Abstract

Discrete choice experiments are increasingly being used to assess preferences for services provided by regulated utilities. A commonly observed tendency of customers to opt for the status quo option may signal unwillingness to trade-off changes in service levels with bills, questioning the welfare theoretic interpretation of stated choices. In this paper, we examine status-quo choices and systematic non-trading behaviour in a discrete choice experiment encompassing a wide range of water-related service attributes. Our analysis is novel in several dimensions. First, we use a split sample design to vary the description of the status quo and the survey administration mode (online vs. in person). Second, we define service attributes to span both improvements and deterioration, so that the status quo is not necessarily the least-cost alternative. Third, we elicit information about the perception of the status quo and the impact of service attributes on day-to-day activities. Our results suggest that status quo choices largely reflect preferences.

Keywords: Cost-benefit analysis; Regulated utilities; Water management; Economic valuation; Discrete choice experiments; Individual decision making; Status quo effects.

JEL classification: **C35, H4, L43, L95, Q25, Q51, Q58**

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1 Introduction

In well-functioning markets individuals make choices to consume different goods and services based on the characteristics of a product, such as its price, its quality or the level of service, along with their attitude towards the supplier and a wider set of factors that includes trends and brand loyalty. By observing these choices producers make decisions about investment priorities, innovations to existing products and levels of service, or develop new products. Many economic sectors however, such as utility suppliers in regulated markets, are not subject to competition, and the role of customer behaviour can be severely diminished or non-existent. In addition regulated utilities are often responsible for the management of non-market environmental resources, the value of which is typically unobserved.

In the absence of market price signals, the discrete stated choice experiment (DCE) (Louviere and Hensher, 1982; Louviere and Woodworth, 1983) offers a highly flexible framework for quantifying customer preferences. Its application can mimic a market setting in which customers trade-off various aspects of service provision.[1] DCEs therefore represent a useful tool to establish investment priorities and inform price control regulation. However, the use of DCEs to examine customer preferences is associated with a number of empirical challenges, including the hypothetical bias of stated preference decision-contexts (Diamond and Hausman, 1994; List, 2001), the incentive compatibility of the choice format (Harrison, 2007), task complexity (Swait and Adamowicz, 2001), and preference 'anomalies' (Bateman et al., 2009; Day and Prades, 2010).

We focus our investigation on the observed phenomenon of the status quo (SQ) effect (Samuelson and Zeckhauser, 1988; Hartman et al., 1990). In a common form of DCE appli-

[1] Originally applied in the context of transportation (Ben-Akiva and Lerman, 1985), its widespread application in recent years has encompassed marketing (Zwerina, 1997), health (Ryan, 1999), and the environment (Adamowicz et al., 1994). Tracing its foundations to the theory of consumer behavior of Lancaster (1966) and Rosen (1974), it is assumed that the utility an individual derives from a good is a function of the characteristics of the good. A DCE mirrors this process via a simulated market where survey respondents are presented with sets of alternative combinations of attributes (characteristics) and are asked to choose their most preferred bundle. Respondents' choices between alternative bundles reveal the trade-offs between the attributes and hence their preferences for independent changes in each attribute.

cation, survey respondents are required to choose between the current situation, representing the default alternative, and two other options that present different levels for the attributes of interest. A SQ effect manifests itself when respondents opt for the SQ alternative disproportionately often in relation to the (inferred) value of alternatives on offer. In this paper, our aim is to provide evidence about whether SQ choices are driven by economic preferences or by non-economic and contextual factors related to information provision and respondent cognition. We examine SQ choices in individual choice tasks as well as systematic SQ choices across all choice tasks; i.e. serial SQ choices. Understanding whether SQ choices reflect trading behaviour is of importance for the use of DCEs as a preference revelation instrument and for the utility-theoretic interpretation of stated choices. Moreover, given the increased use of DCEs as a support to decision-makers, the validity of the DCEs underpins ex-post acceptability of resource allocation decisions.

Our empirical investigation is based on a survey administered to customers of Thames Water Utilities, a regulated water utility in England, UK. We elicited customer preferences for changes in a broad range of water, wastewater and environmental services. Besides evidence on the value of water-related amenities to households, our survey instrument allows us to contribute to the literature on SQ choices in several important ways. First, we use a split sample design to vary the description of the SQ provision. This feature enables us to understand the value of the SQ option beyond DCE attributes included in the choice set, and thus directly observe if SQ choices relate to preferences for maintaining current service levels. Second, we administer the survey online and through face-to-face interviews, which allows us to examine trading behaviour under alternative survey modes. Third, we define attributes' space to span both positive and negative domains, so that the SQ alternative is not necessarily the least-cost option. Fourth, we collect data on a number of potential driver of SQ choices, namely the subjective perception of and satisfaction with the SQ service provision, whether service attributes affects day-to-day household activities, the perception of the survey instrument, protest motives, as well as respondents characteristics.

Our main findings are as follows. The description of the SQ affects the probability of SQ choices, but has little impact on preferences for changes in the provision of services. This is

consistent with the view that SQ choices reflect economic preferences. Such a view is further supported by the finding that respondents who were dissatisfied with the provision of water-related services were less likely to chose the SQ option, all other things equal. On the contrary, while we find some evidence that survey mode (online vs. in person interviews) induced differences in preferences for improvements, it did not influence trading behaviour.

Considering other factors affecting SQ choices, our results bear a great deal of consistency with existing studies. Respondents who felt their daily activities would not be affected by the specified attributes were more likely to remain with the SQ. This suggests that SQ choices might signal respondents' indifference between alternatives rather than a preference for the SQ itself (Balcombe and Fraser, 2011). Similarly, respondents who felt that the survey did not provide sufficient information were almost 10% more likely to select the SQ options in all choice tasks. This issue, however, can be addressed through pre-testing and prompting during the survey, or by including a 'don't know' option to capture uncertain preferences as suggested by (Balcombe and Fraser, 2011). We also find that factors such as age (Boxall et al., 2009) and protest motivations (Meyerhoff and Liebe, 2009) influence the choice of the SQ. Finally, we find that offering an alternative with a negative price decreases the probability of SQ choices, over and above the marginal impact of a price change. This finding is consistent with studies that find an asymmetric perception of the price attribute around the SQ provision (e.g. Lanz et al., 2010; Viscusi and Huber, 2012).

The remainder of this paper is structured as follows. Section 2 provides a brief overview of the current use of DCEs within the water industry in England and Wales and recent findings on SQ effects in the DCE literature. Section 3 describes the survey from which our data are derived. Our empirical analysis of the choice of the SQ option is presented in Section 4. Concluding comments and policy implications are offered in Section 5.

2 Use of DCEs for investment planning by regulated water utilities and the status quo effect

In England and Wales, the water industry is comprised of private utility companies who operate as the regional monopoly supplier for either water and wastewater services or water only services. Price-setting behaviour is regulated by the Water Services Regulation Authority (Ofwat). The amount by which customer bills for water and sewerage services can change each year is determined by the five-yearly Periodic Review process, which scrutinises investment plans of regulated monopolies.

Following examples within the industry that demonstrated the use of cost-benefit analysis (CBA) to justify investment proposals (e.g. Willis et al., 2002), it has been made clear by the regulator that economic analysis is an integral component of investment planning and decision-making. However, the single price paid by customers for water and wastewater services does not reveal the value customers place on aspects such as supply reliability, environmental quality or other aspects of service. Instead non-market valuation techniques have increasingly been applied. The exemplar for valuing benefits of water and wastewater investments in this context is provided by Willis et al. (2005), who use the DCE approach to estimate marginal willingness to pay (WTP) for individual service attributes, such as interruptions to supply, security of supply, sewage flooding of properties, and the ecological quality of rivers. This enables individual component values to be applied within CBA to determine levels of investment across different service attributes, and it has been adopted by the industry as standard practise.

The subsequent widespread application of DCEs in the development of regulated water utilities' investment plans has generated significant scrutiny of stated preference methods by all stakeholders involved in process (including the companies themselves, the regulator, and customer representative groups) as well as on the 'acceptability' of customer bill increases resulting from investment plans based on CBA.[2] There are two main criteria to evaluate the validity of

[2] A comprehensive account of the use of stated preference methods and CBA to support the water industry's investment planning in the 2009 Periodic Review is provided in UKWIR (2010).

DCE studies, each encompassing a range of factors. First, construct validity (Hanemann, 1996) relates to *a priori* expectations based on economic theory and empirical evidence from previous studies. Second, content validity assesses the extent to which attributes were understood and motivations for respondents' choices, and can be evaluated by including diagnostic questions (Schkade and Payne, 1994). There is also the potential to examine respondent's trade-off behaviour to identify patterns in response, which may signal a range of systematic biases and indicate poor content validity of a study (e.g. Swait and Adamowicz, 2001; Bateman et al., 2009; Day and Prades, 2010).

In common with many applications, the approach adopted by Willis et al. (2005) requires survey respondents to repeatedly choose between a SQ option describing the current situation and two mutually exclusive alternatives that present different levels for the attributes of interest. Since the attribute levels are not specified within the experimental design, the SQ option represents a default alternative or outside good. In this format, the SQ effect is a much documented phenomenon whereby respondents opt for the SQ alternative disproportionately often (Samuelson and Zeckhauser, 1988; Hartman et al., 1990). Within the econometric analysis of DCEs the SQ effect can be detected by the inclusion of an alternative specific constant (ASC) (Hensher et al., 2005). This parameter controls for the role of unobserved sources of utility for a particular alternative; hence a positive and statistically significant ASC for the SQ option signals a potential SQ effect.[3]

A number of explanations from economics, psychology, and decision theory perspectives have been offered to account for SQ effects in DCEs. This includes endowment effects and loss aversion (Adamowicz et al., 1998) as well as strategic behaviour such as protest bids and a rejection of the hypothetical market (Hanley et al., 2006). Recent empirical studies suggest that the SQ effect most likely stems from a combination factors. For example Boxall et al. (2009) provide a comparative examination of data from two studies, showing that reducing choice task

[3] We note here that there is a large literature concerning the specification of the ASC within econometric models and the SQ effect on both systematic and stochastic components of utility. See for example Scarpa et al. (2005), Scarpa et al. (2007), and Hess and Rose (2009). Largely current practice favours the inclusion of an ASC for the SQ in 'labelled DCEs' where the SQ option is explicitly presented.

complexity through the number of attributes and levels reduces the probability of SQ choices. They also find that respondents' age, and to a lesser extent education are respectively positively and negatively correlated with SQ choices. Using a diagnostic question approach, Meyerhoff and Liebe (2009) find that protest behaviour is a key driver of SQ choices, in addition to perceived task complexity.

In the context of investment that would affect the provision of water-related services and the use of DCE to inform the price control process, the SQ effect is directly related to the ex-post acceptability of company business plans. On the one hand, SQ choices may signal that service improvements on offer are not regarded as 'value for money', thus representing preferences which are important for investment planning and the industry regulator. On the other hand, if SQ choices stem from an unwillingness of respondents to trade-off service changes and bill amounts due to survey design effects, the cognitive burden imposed by the complexity of the choice task, or and/or protest motivations, this presents a more fundamental concern in terms of content validity, potentially misrepresenting customer preferences and thus the benefits associated with investment plans.

3 Empirical framework: Valuing services of water utilities

Our data is sourced from a survey designed to assess customer preferences for water, wastewater and environmental services. This section describes the key features of our survey instrument and reports a WTP-space analysis of DCE data.

3.1 Survey design and administration

The questionnaire and DCE exercise follow the typical structure for a stated preference survey (Bateman et al., 2002), and were informed by a series of focus groups, cognitive interviews and a pilot to pre-test the survey material. As part of an introductory section, respondents were asked to rank priorities for improvements across a broad range of water, wastewater, environmental and customer service areas. Respondents were then presented with the specific service areas covered by the DCE, and were asked to rate how much each attribute affected their household's

daily activities. After completing the DCE exercise, a series of follow-up questions focused on respondent's motivation for choices and feedback on how easy or difficult they found the choice exercises, and gathered key socio-economic characteristics.

Attributes presented in the DCE are reported in Table 1.[4] For each service attribute, we specified two improvement and two deterioration levels, while the bill attribute features two reductions and three increases. We elicited respondents' preferences for all attributes by using a 'block' approach (Willis et al., 2005), where each block comprises three service attributes plus annual household bill. To mitigate the potential for ordering effect, we randomised the attribution of blocks across respondents.[5] The total number of choice tasks was set to 12, or four tasks per group of attributes. In each choice task, respondents were required to select their preferred option from the current situation (the SQ) and two alternative options with varying levels of the attributes.[6]

Through a split sample design, we employed two alternative treatments of the SQ description; a 'basic' version (denoted 'basic SQ') and an 'extended' version (denoted 'extended SQ'). In the basic treatment, we included a general statement that utility bills would be expected to increase in future years. In the extended treatment, a showcard provided more information on planned wastewater network and river water quality improvements, as well as associated trajectory of bills over time. The latter would be such that average yearly bills would be approximately 30% higher by 2020 due to already committed investments, which corresponds to a 3% year on year increase in current bill.[7] Both versions incorporated a standard cheap talk script to mitigate potential hypothetical bias (Cummings and Taylor, 1999; List, 2001; Landry and List, 2007), reminding respondents of the consequence of their choices and income constraints.

A priori expectations as to effect of presenting an 'extended' version of the SQ description on SQ choices are mixed, and mainly depend on whether respondents' perception of the alternative

[4] The full description presented to respondents is provided in Table A1 of the Appendix.

[5] In particular, restricting the sample to the first block of services presented does not alter our findings.

[6] The experimental design is based on the D-efficiency criteria (see e.g. Street and Burgess, 2007).

[7] In 2011, the average unmetered bill for water and wastewater services in England and Wales was £379 per year. For metered customers the average bill was £325 per year (Ofwat, 2011).

Table 1: Service attribute descriptions

Attribute name	Description	Units (Levels)
Block 1		
Interruption to supply	Number of properties affected each year by unexpected 3-6 hour loss of their water	100,000 properties per year (L-2: 2.5; L-1: 1.5; SQ: 1.2; L+1: 1.0; L+2: 0.5)
Taste of tap water	Number of complaints each year about taste or smell or colour of tap water	1,000 complaints per year (L-2: 7.2; L-1: 5.8; SQ: 4.9; L+1: 3.8; L+2: 2.7)
River water quality	River water quality assessments meeting 'good' or better	Percent per year (L-2: 66; L-1: 69; SQ: 72; L+1: 75; L+2: 78)
Block 2		
Water pressure	Number of properties affected each year by occasional low pressure	100,000 properties per year (L-2: 5.0; L-1: 2.5; SQ: 2.0; L+1: 1.5; L+2: 1.0)
Water use restrictions	Chance of restrictions on the use of water	Percent per year (L-2: 20.0; L-1: 10.0; SQ: 5.0; L+1: 3.3; L+2: 2.0)
Sewage flooding	Number of properties each year with a 1 in 10 year chance of internal sewage flooding	1,000 properties per year (L-2: 2.0; L-1: 1.4; SQ: 1.1; L+1: 0.8; L+2: 0.5)
Block 3		
Water hardness	Number of complaints received each year about the hardness of tap water	1,000 complaints per year (L-2: 1.8; L-1: 1.5; SQ: 1.2; L+1: 0.9; L+2: 0.6)
Pollution incidents	Number of pollution incidents each year	10 incidents per year (L-2: 5; L-1: 3; SQ: 2; L+1: 1; L+2: 0.5)
Wastewater treatment odour	Number of properties affected each year by smell from sewage treatment	1,000 properties per year (L-2: 10.0; L-1: 5.0; SQ: 2.0; L+1: 1.0; L+2: 0.5)
All blocks		
Bills	Change in annual household water and sewerage bill	UK£ per year (L-2: -30; L-1: -15; SQ: 0; L+1: +10; L+2: +20; L+3: +30)

baselines.[8] If the value of service improvements stemming from already committed investments are perceived to be higher than the described bill increase, the value of the SQ option would tend to be higher in the 'extended' treatment. On the contrary, if the projected bills increase of the 'extended' treatment appear large relative to improvements the value of the SQ option would be higher in the 'extended' treatment. In addition, the information on future bills may give rise to a greater incidence of protest responses, for example because respondents may associate bill increases with undue profits earned by the company.

[8] If planned improvements are perceived as substitutes to the proposed improvements, there could also be a decrease in the value of additional investments, whereas income effects would tend to reduce WTP. We do not find conclusive evidence of this effect in the data.

A second split sample experiment is conducted to assess the effect of administering the 'extended' treatment both online and through a computer aided personal interview (CAPI) approach. Online survey administration is becoming popular because of its lower cost and increased internet access in the population (see for example Lindhjem and Navrud, 2011; Nielsen, 2011). Participation of respondents to an online survey is more difficult to control, and there is scope for sample selection effects, as respondents with high valuation for the attributes are more likely to complete the survey. However, CAPI administration could lead to an interviewer effect, potentially increasing trading behaviour relative to online survey administration.

The survey was administered in Autumn 2011 with quotas set to approximate population statistics for the company customer, in terms of gender, age and socio-economic status of the respondents (see Table A2 of the Appendix). A total of 1,017 household customers were surveyed via CAPI, split approximately 50:50 between the 'basic SQ' and 'extended SQ' treatments. A further 500 customers were surveyed via an online questionnaire, which administered the 'extended' information version only.

3.2 Results: Discrete choice experiments

Stated choices are analysed in the random utility framework, which is based on the assumption that respondents chose the alternative, or set of characteristics of the good, they most prefer. Formally, a respondent i chooses alternative j over j' in choice task t if the utility of j is greater than the utility of j'. The utility of alternative j is given by:

$$U_{ijt} = V_{ijt} + \epsilon_{ijt}\,, \quad i = 1, \ldots, N\,, \quad j = 1, \ldots, J\,, \quad t = 1, \ldots, T\,,$$

where, from the viewpoint of the analyst, V_{ijt} and ϵ_{ijt} are the observed and unobserved parts of utility respectively. We specify the individual utility functions V_{ijt} as a linear function of

attributes' levels:[9]

$$V_{ijt} = \sum_{k} \theta_{ik} X_{kjt} - \gamma_i P_{jt}$$

where the θ's measure the marginal utility (or tastes) for improvements, X_{kjt} are levels of improvement specified in alternative j, γ is the marginal utility of money, and P_{jt} is the price of j.

To directly compare estimates across different blocks of services and split samples, we use a 'WTP-space' approach to estimation (Train and Weeks, 2005). Defining WTP for service improvements as $\beta_{ik} = \theta_{ik}/\gamma_i$, money-metric utility is obtained by rescaling utility through γ. Furthermore, we control for the presence of individual-level heterogeneity in tastes (Revelt and Train, 1998) by modeling taste coefficients as: $\beta_{ik} \sim N(\overline{\beta}, \sigma_k)$ and $\gamma_i \sim \log N(\overline{\gamma}, \sigma_\gamma)$. Given the labeled nature of the choice exercise, we include a status quo ASC and estimate its monetary value assuming the same form of heterogeneity as for other attributes.

Estimation for each block and split sample was carried out using simulated maximum likelihood.[10] Results are reported in Table 2. Explanatory variables are coded such that we expect a positive coefficients (WTP) on all service attributes (an increase implies an improvement in the level of service). All parameter indeed have the expected sign, and most are highly statistically significant. The one exception to this pattern of findings is the 'water use restrictions' attribute, which is found to be statistically insignificant for two of the three sub-samples. This finding however is consistent with wider results from our survey that indicate the relatively minor impact that non-essential water use bans have on households. Also, we note that significant preference heterogeneity prevails across all blocks and sub-samples, as shown by the highly statistically significant standard-deviations estimates.

Comparing WTP estimates for water and wastewater services, we do not detect significant differences in parameter estimates for the Basic and Extended SQ treatments administered

[9] While this is not the focus of this paper, we note that the presence of improvements and deterioration in service levels can give rise to non-linear value functions. However, although we find evidence that the bill attribute is perceived differently if it is an increase or decrease of the same magnitude, we do not find evidence on non-linearities for service attributes.

[10] Likelihood ratio tests suggests that subsamples should not be pooled. We use 500 Halton draws to approximate the integral of the unconditional likelihood of each panel choices.

Table 2: Discrete choice experiment: WTP-space estimation

Attribute	CAPI Basic SQ		CAPI Extended SQ		Online Extended SQ	
	Mean	Std-dev.	Mean	Std-dev.	Mean	Std-dev.
Block 1						
Interuption to supply	9.135***	8.538	10.02***	15.39**	9.607***	6.927***
	(2.194)	(7.472)	(2.656)	(6.155)	(1.155)	(1.248)
Taste of tap water	6.294***	9.041***	8.459***	11.04***	6.794***	9.398***
	(1.012)	(1.726)	(1.303)	(2.156)	(0.610)	(0.773)
River water quality	2.765***	3.944***	2.805***	3.567***	1.490***	2.188***
	(0.408)	(0.644)	(0.462)	(0.814)	(0.189)	(0.279)
Bills	-3.144***	0.371	-3.229***	0.501	-1.282***	1.911***
	(0.177)	(0.271)	(0.250)	(0.331)	(0.453)	(0.307)
SQ ASC	38.78***	43.11***	30.35***	36.24***	20.34***	17.74***
	(4.736)	(5.777)	(5.708)	(8.337)	(1.559)	(1.365)
N respondents	501		516		500	
Pseudo R^2	23.5		26.6		22.1	
Block 2						
Water pressure	9.129***	8.357***	8.101***	6.234*	5.337***	4.529***
	(1.752)	(3.152)	(2.150)	(3.343)	(0.689)	(0.577)
Water use restrictions	-0.194	0.654	-0.192	0.0419	0.480***	1.066***
	(0.203)	(0.891)	(0.156)	(0.210)	(0.112)	(0.124)
Sewage flooding	32.63***	21.80***	26.10***	18.62***	20.48***	21.25***
	(3.972)	(5.041)	(4.173)	(4.754)	(1.712)	(1.615)
Bills	-2.695***	1.067***	-2.013***	1.829***	-1.476***	1.753***
	(0.280)	(0.258)	(0.343)	(0.264)	(0.494)	(0.330)
SQ ASC	34.56***	34.16***	25.65***	17.45***	12.99***	15.17***
	(4.611)	(5.876)	(2.996)	(2.688)	(1.603)	(1.594)
N respondents	501		516		500	
Pseudo R^2	27.9		22.8		21.8	
Block 3						
Water hardness	9.225***	2.379	8.335***	10.16***	4.458***	10.10***
	(2.078)	(7.862)	(1.344)	(2.073)	(1.123)	(1.125)
Pollution incidence	8.656***	15.12***	9.125***	12.79***	8.319***	7.565***
	(1.786)	(2.923)	(1.438)	(2.270)	(0.845)	(0.838)
Wastewater treatment odours	5.545***	5.944***	2.720***	0.885*	2.075***	0.0573
	(1.188)	(1.498)	(0.377)	(0.458)	(0.247)	(0.469)
Bills	-3.545***	0.468	-2.184***	1.591***	-1.998***	1.407***
	(0.285)	(0.395)	(0.497)	(0.378)	(0.361)	(0.290)
SQ ASC	55.18***	70.92***	27.51***	32.74***	13.06***	20.46***
	(9.734)	(14.03)	(3.950)	(3.731)	(1.830)	(2.180)
N respondents	501		516		500	
Pseudo R^2	26.6		22.9		20.9	

Notes: Standard errors in parentheses; *** p-value<0.01, ** p-value<0.05, * p-value<0.1.

through CAPI. Regarding survey mode, we find that WTP for improvements in the online survey are generally lower compared to a CAPI administration, although the difference is mostly small and statistically insignificant. In fact, attitudinal questions reveal that a larger fraction of online respondents reported some problems with current service levels, suggesting a sample selection effect. Utility-space estimation also suggests that online respondents generally displayed stronger preferences regarding service improvements. However, estimates of the average marginal utility of money are significantly larger for online respondents, as CAPI respondents were more inclined to select alternatives with larger bills increases, suggesting an interviewer effect. In WTP-space, stronger taste for service improvements appear to be 'compensated' by a higher sensitivity to bills increase.

Turning to the SQ ASC, estimates are positive and highly statistically significant across samples. This indicates that, all other things equal, respondents value the SQ over and above the value given to attributes defining that alternative. The split samples reveal further interesting variations. First, respondents who were administered the 'basic' SQ treatment display much larger preferences for the current situation compared to other subsamples, suggesting that the value of improvements described in the 'extended' treatment do not offset the associated bill increase. Second, respondents to the online survey exhibit the smallest SQ effect, supporting the sample selection effect. Furthermore, for all sub-samples we observe significant heterogeneity in preferences concerning the current situation, as indicated by the statistical significance standard deviation of the ASC. For some respondents, the current situation is perceived negatively, and they would need to be compensated for staying with the SQ.

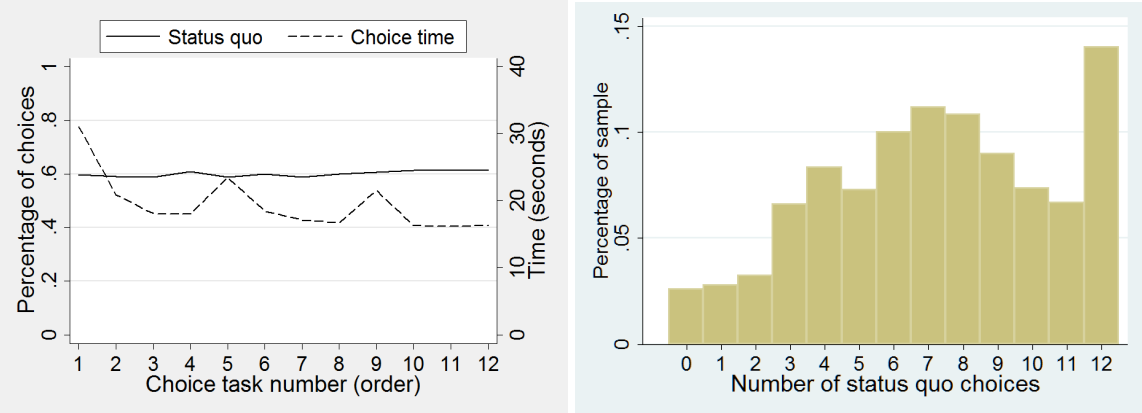
4 Status quo choice analysis

This section provides a detailed account of SQ choices by respondents and their motivations. We first provide descriptive statistics and then regression analysis.

4.1 Descriptive statistics

Figure 1 describes the frequency of SQ choices across choice tasks. As panel (a) shows, around 60% of the combined sample chose the SQ in any given choice task. While SQ choice frequency remains fairly constant across choice tasks, the average completion time for each task declines as the respondent progress through the exercise. As a new DCE block with different attributes is presented, the response time in each task significantly increases (see choices 5 and 9). This suggests that respondents get more familiar with the trading-off exercise but that it has no apparent impact on SQ choices.

Figure 1: Descriptive statistics on status quo choices



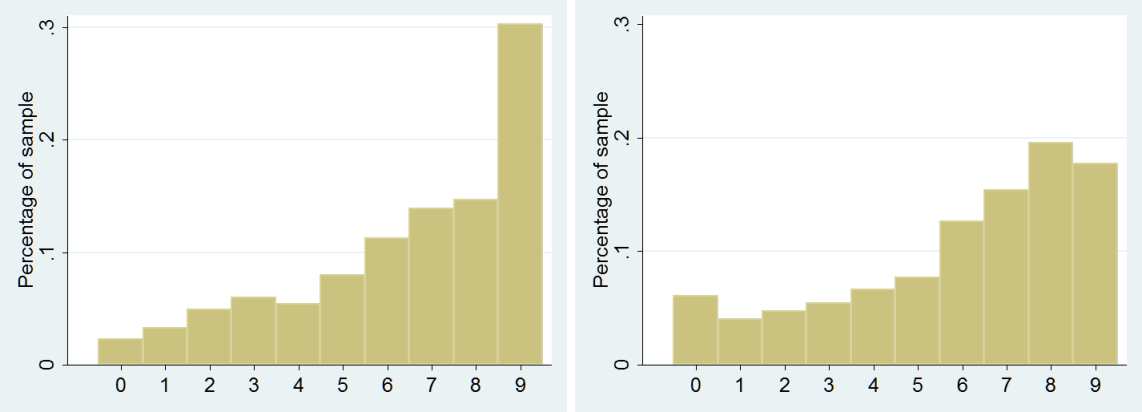
(a) Choice sequence

(b) Trading behavior

In panel (b) of Figure 1, we report the number of SQ choices for each respondent. Less than 3% of respondents always choose a non-SQ alternative. On average, respondents chose the SQ in around half of their choice tasks, which suggest that the participation in the hypothetical market is significant. An interesting feature of the distribution is the high concentration of respondents who opt for the SQ in every choice task (about 14%), almost twice as high as that of respondents who selected non-SQ alternatives once.

While we provide a more complete account of the determinants of the SQ choice in the next section, our survey instrument elicited responses on two key potential drivers of SQ choices. These are portrayed in Figure 2. First, Panel (a) of Figure 2 provides evidence about the per-

Figure 2: Household perception of service provision



(a) Number of attributes with satisfactory level of service

(b) Number of attributes not affecting daily activities of household

ception of the SQ, reporting the number of service attributes for which respondents reported to be 'happy' with the current level of service. Around 30% of respondents are satisfied with the current level of service for all nine attributes. Only two percent of respondents indicated that service levels for all attributes needed improvements.

Second, we elicited how much each of the service attributes affect the daily activities of the respondent's household. Panel (b) shows that only 5% of respondents reported that all attributes affected their daily lives, and almost 20% stated their daily activities were not affected 'at all' by any of the nine attributes.

With Spearman's rank correlation of 56.4%, a large fraction of households who reported their satisfaction with current service levels were also those who reported that they did not directly affect their daily activities. Conversely, respondents who stated that their daily activities were affected were also those who expressed their dissatisfaction with current service levels. Hence for many respondents the SQ is valuable because they are satisfied with current service levels or because they do not feel not directly affected by changes in the provision of service attributes.

4.2 Econometric models

The traditional approach to analyse SQ choice is to decompose the variance of the SQ ASC by interacting it with measures of survey respondent characteristics (e.g. Meyerhoff and Liebe, 2009). This is typically carried out in a multinomial logit framework, which is the best suited approach to analyse discrete choices with multiple options. However, estimating a large number of interaction terms requires large datasets, and thus limits the number of candidate explanatory variables.

As an alternative, we treat the choice between SQ and non-SQ options as a separate process, and estimate the probably of selecting the SQ option as opposed to one of the other alternatives. First, we analyse the drivers of SQ choices in each choice task separately. Second, we examine the factors that influence serial SQ choices, reflecting non-trading behaviour.

4.2.1 Assessing the determinants of status quo choices

To analyse the probability of observing a SQ choice in each choice occasion and across all DCE blocks, we pool data on the 12 choice tasks. Thus for each respondent we observe 12 binary SQ outcomes and we exploit variations both within and across respondents. We use a simple linear probability model to explain the probability of observing a respondent selecting the SQ versus one of the other alternatives conditional on a number of controls.[11] Formally, the model is specified as:

$$Prob(SQ_t = 1|X_{kjt}, P_{jt}, Z_l, W) \quad = \quad \alpha + \sum_{kj} \delta_{kj} X_{kjt} + \sum_{j} \lambda_j P_{jt} + \sum_{l} \omega_l Z_l + \rho' W$$

where X_{kjt} and P_{jt} represent the attributes' levels of each alternative, Z_l is a set of indicator variables for each DCE block, and W is a vector of individual and survey characteristics that

[11] Since linear probability models can generate predictions outside the [0,1] domain, a non-linear transformation of the regression function can be used, yielding models such as binomial logit and probit. We favour the linear probability model because estimates can directly be interpreted as marginal probabilities, whereas logit and probit model require evaluating marginal effects at a point in the sample. Further analysis revealed that marginal effects from both logit and probit models evaluated at the sample mean provide results that are similar to those from the linear probability model.

remain constant across choice tasks. α, δ, λ, ω and ρ are the parameters to be estimated from the data.

Results from the estimation using robust standard errors to account for the non-spherical error variance are reported in Table 3. Overall, the fit of the model is relatively low ($R^2 = 5.6\%$) , which is to be expected given we explain a binary outcome with a continuous function. However, the F-test of the model suggests the model is valid (p-value<0.001), and marginal improvements in service attributes mostly display the expected sign, with an increase in service level reducing the probability of choosing the SQ, except for the bills. The only exception is 'water use restrictions', which was already found to be not statistically different from zero in the multinomial estimation.

Coefficients associated with Block 2 and 3 are not statistically significant, so that probability of observing a SQ choice is not systematically higher for either groups of attributes. We also observe significant differences in the marginal probabilities of a change in bills in each alternative independently, with the probability of choosing the SQ being twice higher for a bill increase in Alternative 1 as compared to a similar increase in Alternative 2.[12] More interestingly, we observe that if one of the two alternatives included a decrease in bills, the probability of choosing the SQ declines by about 4.5%. This finding suggests that in DCE applications where alternatives other than the SQ are always costly, SQ choices capture preferences of respondents who would be willing to 'sell' their endowment on a market.

Variables measuring attributes' levels are complemented by a set of controls for respondents' and survey characteristics.[13] First, we include measures of whether a respondent perceived the current level of service of an attribute to be satisfactory. We find consistent evidence that the probability of SQ choices increases with service satisfaction, even when controlling for the improvement level. Compared to the marginal probability estimates for service improvements, the impact of those variables are large. Similarly, respondents who stated they were not being

[12] Attributes measuring 'water hardness' and 'water pressure' are not statistically significant at the usual levels when appearing in Alternative 2. This is most likely a failure of the experimental design to identify alternative-specific coefficients, and most coefficients are similar across alternatives.

[13] Summary statistics are reported in Table A3 of the Appendix.

Table 3: Analysis of status quo choices across all blocks: Linear probability model

DCE block	DCE attribute	Marginal improvement		Happy with the	Not affected by
		Alternative 1	Alternative 2	current provision (=1)	changes (=1)
Block 1 (baseline)	Interruption to supply	-0.0181*	-0.0228**	0.0458*	-0.00365
		(0.0105)	(0.0109)	(0.0246)	(0.0231)
	Taste of tap water	-0.0238***	-0.0206***	0.0365	0.125***
		(0.00439)	(0.00437)	(0.0250)	(0.0225)
	River water quality	-0.00708***	-0.00700***	0.0377**	-0.0199
		(0.00176)	(0.00174)	(0.0190)	(0.0197)
Block 2 (=1) -0.00913 (0.033)	Water pressure	-0.0276***	-0.000807	0.0353	0.0314
		(0.00540)	(0.00528)	(0.0255)	(0.0228)
	Water use restrictions	0.00248**	-0.00457***	0.0456*	0.0183
		(0.00117)	(0.00104)	(0.0259)	(0.0235)
	Sewage flooding	-0.121***	-0.0934***	0.0260	0.0289
		(0.0143)	(0.0147)	(0.0322)	(0.0258)
Block 3 (=1) -0.019 (0.0274)	Water hardness	-0.0126*	-0.00839	0.0242	0.0446**
		(0.00718)	(0.00692)	(0.0205)	(0.0223)
	Pollution incidents	-0.0144***	-0.0240***	0.0375*	0.0411
		(0.00486)	(0.00439)	(0.0209)	(0.0258)
	Wastewater treatment odour	-0.0125***	-0.0120***	0.0333	0.0176
		(0.00210)	(0.00192)	(0.0233)	(0.0265)
All blocks	Bills	0.00426***	0.00262***	-	-
		(0.000272)	(0.000309)	-	-
	Negative bill amount (=1)	-0.0454**	-	-	-
		(0.0204)	-	-	-
Protest motives	Changes unlikely (=1)	0.0266*	*Survey perception*	Interesting (=1)	-0.0191
		(0.0150)			(0.0155)
	Consumers shouldn't pay (=1)	0.0279*		Complicated (=1)	0.00459
		(0.0143)			(0.0243)
	Insufficient information (=1)	0.0595*		Educational (=1)	-0.0281
		(0.0331)			(0.0187)
Respondent characteristics	Age (years)	0.00132***	*Survey characteristics*	Online survey (=1)	0.000999
		(0.000424)			(0.0190)
	Gender (female=1)	0.0482***		Extended SQ (=1)	-0.0338**
		(0.0136)			(0.0166)
	Higher education (=1)	-0.0212		Task order effect (1-12)	0.00216**
		(0.0153)			(0.00104)
	Socio-econ groups (A/B/C1=1)	0.00415			
		(0.0153)			
Constant term	0.311***				
	(0.0389)				

Notes: N = 18,204; Robust standard errors in parentheses; *** p-value<0.01, ** p-value<0.05, * p-value<0.1.

affected by an attribute under consideration were more likely to select the SQ, although the effect is only statistically significant for the 'taste' and 'hardness' attributes. For these attributes, the marginal effect is 12.5% and 4% respectively, suggesting that satisfaction with these services is key to the participation in the hypothetical market.

The second individual characteristic we consider is that of protest motives, which is usually associated with non-trading behaviour in the contingent valuation literature (Freeman, 1986; Halstead et al., 1992). We include three measures signalling protest behaviour: (i) if the respondent did not find the survey scenario credible, believing that changes would be unlikely to happen even if bills would increase as proposed; (ii) if the respondent stated that water customers should not be responsible for paying for service improvements, but rather that these should be funded by the water company or the Government; and (iii) if the respondent stated there was insufficient provision of information to make informed choices. All three indicators of protest behaviour are associated with an increase in the probability of choosing the SQ option and are statistically significant ($p<0.1$). The perception that insufficient information was provided is found to have the largest marginal effect, which suggests that prompting for additional information or including a 'don't know' option would better align choices with preferences.

The next set of controls measures perceptions of the survey instrument and respondents' characteristics. We find that respondents who stated that the questionnaire was interesting or educational were less likely to choose the SQ, and that those who found the exercise complicated were more likely to select the SQ option. These effects, which are not directly related to preferences for services, are small and not statistically significant. Regarding age, gender, education and socio-economic group (a proxy for income), the data suggest that older respondents and females were more likely to choose the SQ, all other things equals, whereas education and socio-economic status are not found to be statistically significant at conventional levels.

The final set of explanatory variables relate to the survey instrument. First, we find no significant difference in the choice of the SQ between online and CAPI respondents. Note that this result only holds if we control for respondents' perception of service attributes, which again suggests an issue of self-selection in the online sample. Second, consistent with the previous

results, we find that the extended SQ treatment reduces the probability of SQ choices, all other things equal. Third, we include a variable measuring the choice task order from 1 to 12 and find that the probability of a SQ choice increases with the duration of the exercise, suggesting a small but statistically significant tendency to select the SQ as the exercise progresses, with the probability of SQ choices increasing by 2% between the first and the last choice, all other things equal. Note that further empirical tests did not support the presence of non-linearity in the task ordering effect.

4.2.2 Assessing the determinants of serial SQ choices

We now analyse the probability that respondents systematically chose the SQ option in all 12 choice tasks. This measures the participation of respondents in the choice exercise, or the willingness to engage in the trade-offs on offer. In this setting, we have one observation per respondent, so that the sample consists of 1,517 binary outcomes. As above, we use a simple linear probability model formulated as:

$$Prob(\sum_{t} SQ_t = 12 | X_{kjt}, P_{jt}, Z_l, W) \quad = \quad \alpha + \rho' W$$

where we only exploit individual and survey level characteristics W, and α, ρ are parameters to be estimated from the data. Results of the estimation are reported in Table 4.

The first two explanatory variables concentrate on the perception of the SQ, namely the number of attributes perceived not to affect the respondent's household daily activities, and the number of attributes whose provision is satisfactory. Both variables range from 0 to 9, and both have a strong positive impact on participation in the DCE. These effects are of practical and statistical significance, supporting the view that for some respondents SQ choices reflect preferences for the SQ provision.

The second set of explanatory variables concentrate on protest motives. Respondents who questioned the credibility of the scenario or protested against the payment vehicle were more likely to chose the SQ option in all choice tasks, although the effect is not statistically significant at conventional levels. More importantly, we find that 'insufficient information' has a large and

Table 4: Analysis of serial non-participation: Linear probability model

DCE attributes	Happy with the current provision (number of attributes: 0-9)	0.00918** (0.00364)			
	Not affected by changes (number of attributes: 0-9)	0.00954** (0.00399)			
Protest motives	Changes unlikely (=1)	0.0240 (0.0199)	*Survey perception*	Interesting (=1)	0.00305 (0.0198)
	Consumers shouldn't pay (=1)	0.00546 (0.0188)		Complicated (=1)	0.0727** (0.0295)
	Insufficient information (=1)	0.110*** (0.0414)		Educational (=1)	-0.0488* (0.0256)
Respondent characteristics	Age (years)	0.00124** (0.000563)	*Survey characteristics*	Online survey (=1)	-0.00732 (0.0247)
	Gender (female=1)	0.0167 (0.0178)		Extended information (=1)	-0.0147 (0.0215)
	Higher education (=1)	-0.0237 (0.0203)			
	Socio-econ groups (A/B/C1=1)	0.0132 (0.0201)			
Constant term	-0.0540 (0.0467)				

Notes: N = 1,517; Robust standard errors in parentheses; *** p-value<0.01, ** p-value<0.05, * p-value<0.1.

statistically significant impact on serial SQ choices, confirming the importance of this determinant. As already discussed, this issue can be addressed prior to the survey administration.

The third set of variables measure the perception of the survey. Interestingly, we find that self-assessed complexity of the choice exercise correlates with market participation. The more complex the exercise is perceived to be, the greater the probability of serial SQ choices. Conversely, respondents who stated that the survey was educational are less likely to be serial non-participants.

Finally, we include a set of respondent and survey characteristics. Among respondents' characteristics, only age is a statistically significant determinant of the non-participation. We also find that the probability of serial SQ choices does not significantly differ across split samples, all other things equal. Indeed, neither varying the SQ description nor an 'online survey' dummy have a statistically significant impact on non-participation.

5 Concluding remarks

The aim of this paper has been to examine the SQ effect in the DCE framework, highlighting a number of novel factors that influence the choice of the SQ option. Our investigation is motivated by the recent experience of the water services industry in England and Wales where much emphasis has been placed on the application of DCEs to elicit customer preferences in the absence of market price signals. Since the results from these studies feed into the investment planning process that informs price control, welfare theoretic interpretation of choices is a basic feature underpinning the validity of DCEs.

While conclusions from our empirical investigation are necessarily restricted to our sample, our findings accord with prior expectations both in terms of sign and statistical significance of coefficient estimates. We consider a broad range of attributes including water, wastewater and environmental service attributes, different interview methods (CAPI versus online) and alternative SQ descriptions. In a standard multinomial logit analysis, we find significant heterogeneity in preferences concerning the SQ option and this is supported by examination of respondents' current perception and satisfaction with current levels of service, and the perception of the affect of these on their day to day activities. From our econometric investigation of SQ choices, evidence from SQ choices across choice tasks as well as from the systematic choice of the SQ option suggest that SQ choices mostly reflect economic preferences.

The only key exceptions are the perception that insufficient information was provided, and some individual characteristics such as gender and age. For the first factor, the survey design should ensure that sufficient information is provided to respondents – although it is recognised that there si a balance to be struck between information provision and cognitive effort – while demographic factors call for the use of representative samples. However, it should also be noted that the SQ effect is not only a feature of DCEs, and that it can be observed in many other market and non-market settings.

We conclude by highlighting the main policy-relevant finding of this paper. Our data suggests that SQ choices largely represent either a genuine satisfaction with current service levels,

or that respondents are not affected by changes in these attributes. In particular, it is not the case that service improvements are not valued - as evidenced by the findings from our welfare estimates - but value for money is a key issue for customers. Satisfaction with current service levels is not an unsurprising finding across the water sector in England and Wales were service levels are already high and failures in service might not be not readily perceived or experienced by customers. While it does appear that survey complexity and cognitive burden do not unduly influence respondents choices in DCEs, the key message from our analysis reinforces the emphasis that investment plans need to be based on preferences of customers and that they pass rigorous cost-benefit tests.

Table A 1: Attribute descriptions presented to respondents

Unexpected interruptions to supply	Interruptions to the water supply can occur without any warning or notice due to pipes bursting or equipment failing. This could happen at any time of the day or night. Affected properties have no water supply for a temporary period (between 3 to 6 hours).
Taste, smell or colour of tap water	Some customers experience recurring incidents of unpleasant taste or smell or discolouration of their tap water. Properties can be affected over a period of time (e.g. a week) and running the tap for several minutes does not remove the taste, smell or discolouration.
River water quality	All rivers in Europe should meet environmental quality standards that aim to improve the status of natural habitats. The quality of rivers and stream habitats for wildlife and use by people can be affected by treated wastewater discharged from sewage treatment works.
Low water pressure	Low water supply pressure can be due to a property's location or a reduction in mains pressure. It affects the use of taps, showers and boilers - for example it can take up to 5 times longer to fill a bowl of water. 'Occasional' means the water pressure is not low all the time but becomes lower in several one-off incidents over a year.
Water use restrictions	During long periods of dry weather and low rainfall - usually summer months - it may be necessary to restrict the use of water by customers. Restrictions on uses like watering gardens and parks, washing cars and windows, and filling swimming pools conserves water for essential uses (drinking, cooking and washing) and helps maintain river levels to protect water habitats and wildlife.
Sewage flooding	Very occasionally, problems with sewers particularly during periods of heavy rainfall can result in untreated sewage escaping from sewers. Internal sewage flooding means that the sewage water gets into houses and other buildings. This could be in basement areas or in ground level rooms.
Hardness of tap water	Hardness of tap water refers to the mineral content of water. This is not a concern for public health and the water is safe to drink, but it does affect the use of kettles, boilers and other appliances through 'scaling'. This is an issue all year round for customers in the affected areas.
Pollution incidents	The Environment Agency for England and Wales sets standards for discharges of sewage, in order to protect the wildlife in rivers and the use of rivers by people. Occasionally the sewerage system is affected by mechanical failures, blockages and heavy rain. This can result in the discharge of untreated sewage to rivers. This may affect the wildlife in rivers for a temporary period of time.
Wastewater treatment odour	Sewers and sewage treatment works can be the source of complaints about unpleasant smell and nuisance, such as flies, even when they are operating normally. Properties close to treatment works are most affected and problems can also be worse in warmer weather.

Table A 2: Sample representativeness

	Online			CAPI					Quota
	Frequency	Percentage		Frequency			Percentage		Percentage
Sub-sample	Extended	Extended	Basic	Extended	Total	Basic	Extended	Total	N/A
Gender									
Female	261	52.2	275	274	549	53.3	54.7	54.3	52.0
Male	239	47.8	241	227	468	46.7	45.3	45.7	48.0
Total	500	100.0	516	501	1017	100.0	100.0	100.0	100.0
Socio-economic status									
AB	164	32.8	159	149	308	30.8	29.7	30.3	28.0
C1	176	35.2	156	156	312	30.2	31.1	30.7	32.0
C2	64	12.8	90	98	188	17.4	19.6	18.5	11.0
D	43	8.6	60	58	118	11.6	11.6	11.6	14.0
E	53	10.6	51	40	91	9.9	8.0	8.9	15.0
Total	500	100.0	516	501	1017	100.0	100.0	100.0	100.0
Age									
18 - 29	120	23.9	104	118	222	20.2	23.6	21.8	24.0
30 - 44	165	32.8	172	158	330	33.3	31.5	32.4	33.0
45 - 59	105	21.1	141	117	258	27.3	23.4	25.4	21.0
60+	110	22.2	99	108	207	19.2	21.6	20.4	22.0
Total	500	100.0	516	501	1017	100.0	100.0	100.0	100.0

Table A 3: Sample summary statistics (N = 1517)

Definition	Mean	Min	Max
Dependent variable			
Status quo choice	0.60	0	1
Happy with the current provision			
Interruption to supply	0.81	0	1
Taste of tap water	0.79	0	1
River water quality	0.60	0	1
Water pressure	0.82	0	1
Water use restrictions	0.82	0	1
Sewage flooding	0.80	0	1
Water hardness	0.50	0	1
Pollution incidents	0.61	0	1
Wastewater treatment odour	0.74	0	1
Number of attributes (0-9)	6.48	0	9
Not affected by changes			
Interruption to supply	0.75	0	1
Taste of tap water	0.63	0	1
River water quality	0.64	0	1
Water pressure	0.61	0	1
Water use restrictions	0.72	0	1
Sewage flooding	0.83	0	1
Water hardness	0.28	0	1
Pollution incidents	0.75	0	1
Wastewater treatment odour	0.74	0	1
Number of attributes (0-9)	5.95	0	9
Survey perception			
Interesting	0.49	0	1
Complicated	0.12	0	1
Educational	0.15	0	1
Protest motives			
Changes unlikely	0.33	0	1
Consumers shouldn't pay	0.62	0	1
Insufficient information	0.05	0	1
Respondent characteristics			
Age (years)	44.74	25	70
Gender (female)	0.53	0	1
Higher education	0.37	0	1
Socio-econ groups (A/B/C)	0.63	0	1
Survey characteristics			
Online survey	0.33	0	1
Extended information	0.66	0	1

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