NIA ENWL010
Value of Lost Load to Customers

Technical Appendices

5 October 2018

VERSION HISTORY

Version	Date	Author	Status	Comments
0.1	28 June 2018	Impact Research	Draft	
1.0	26 September 2018	Impact Research	Final	Incorporating feedback from Electricity North West

APPROVAL

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GLOSSARY

Abbreviation	Term
CBC	Choice-based conjoint
CE	Choice experiment
CV	Contingency valuation
DECC	Department of Energy and Climate Change
DNO	Distribution network operator
DSR	Demand side response
ECP	Engaged customer panel
EV	Electric vehicle
GB	Great Britain
HB	Hierarchical Bayesian
I&C	Industrial and commercial
LCN Fund	Low Carbon Networks Fund
LCT	Low carbon technology
LE	London Economics
MNL	Multinomial Logit
NIA	Network Innovation Allowance
NPV	Net present value
Ofgem	Office of Gas and Electricity Markets
OLS	Ordinary least squares
RIIO-ED1	Electricity distribution price control 2015 to 2023
SME	Small to medium enterprise
SPSS	Statistical package for the social sciences (software package used for advanced statistical analysis)
SSI	Survey Sampling International
VoLL	Value of Lost Load
WTA	Willingness to accept
WTP	Willingness to pay

1 THE CHOICE EXPERIMENT

1.1 Why use a choice experiment?

Where feasible, macro-economic approaches have been used to derive a figure for VoLL indirectly. These comprise calculations of the actual costs incurred by customers as a result of supply interruptions, either in the form of actual monetary losses or as revealed in the way people respond (eg by running generators, paying for substitutions or repairs to damaged appliances). The main shortcomings of these approaches are that they are either too simplistic or the data is not sufficiently varied. Approaches that attempt to measure the costs incurred, such as the value of lost leisure time related to household income, can be too broad or subjective. Where 'revealed preferences' are the intended measure, the principle difficulty is that there are very few examples of actual outages that impact directly on consumer behaviour in developed countries.

The alternative approach of using consumer surveys to derive 'direct' estimates of VoLL uses methods that measure precise values of the amount that consumers are willing to pay or accept in relation to avoiding or being compensated for outages. The drawback of this method is that the responses are hypothetical and the task unfamiliar to utility customers.

There are two commonly used stated preference methods: contingency valuation (CV) and choice experiments (CE). CV asks directly what a respondent would pay or want to receive in relation to a specific outage example, whereas CE presents a number of elements all varying at the same time. CV is prone to bias in the form of respondents giving socially acceptable responses and/or answering strategically to influence the study findings. CE deters such responses because of the multiple trade-offs involved in each choice. As a result, CE has been widely used in studies of VoLL.

The chosen approach for this study has drawn extensively from the work carried out by London Economics (LE) in 2013. A paired-choice CE was constructed in which alternative supply interruptions (expressed in terms of duration and frequency) were presented alongside different bill levels.

1.2 Willingness to pay and willingness to accept

Studies consistently observe that the amount that consumers are willing to pay to avoid a deterioration in their current service is considerably less than the amount they would wish to be compensated for experiencing such a deterioration. According to Lanz et al[1], "Asymmetry in willingness to pay (WTP) and willingness to accept (WTA) is one of the most documented phenomena in empirical literature… the empirical evidence is pervasive and gain–loss effects have been observed for a wide variety of economic goods."

Possible explanations for this difference in WTP/WTA values include substitution effects (eg utility customers may perceive limited options for substitution when an outage occurs, so increasing the desire for compensation when a loss in service is experienced), income effects (WTP will be constrained by disposable income) and psychological effects, primarily 'loss aversion', where some decision-makers will perceive losses much more negatively than gains of a similar size. The last point is determined by consumers' 'reference states' – that is, the level of service against which they assess the gain or loss.

The extent of WTP/WTA asymmetry suggests that both measures should be covered in any study of VoLL, indicating lower and upper value bounds. The following aspects of the CE

1 Bruno Lanz, Allan Provins, Ian J. Bateman, Riccardo Scarpa, Ken Willis, Ece Ozdemiroglu, "Investigating Willingness to Pay–Willingness to Accept Asymmetry in Choice Experiments" In Choice Modelling: The State-of-the-art and The State-of-practice. Published online: 19 Feb 2016; 517-541.

design employed in this study reference in a limited way some of these potential reasons for the asymmetry of values:

- Prior to the CE, respondents were asked to consider the impact of outages on their households/businesses and to indicate how they would cope with the loss of supply (substitution effects)
- In the paired choices presented to survey respondents, neither option was presented as the current level of service. This sought to minimise loss aversion and inertia by avoiding an obvious ‘status quo’ choice
- In the use of the VoLL derived from the CE models, an adjustment was applied for low income groups to recognise disparity in incomes (income effects).

1.3 Attribute selection

Presenting price and payment levels

Each respondent was shown six paired choices presented in a WTP context and six in a WTA context. This followed the approach used in the LE 2013 study and is consistent with general practice regarding the number of scenarios thought suitable for respondents. The order was varied randomly, but always as blocks of six WTP or six WTA; introductory text before each block highlighted the nature of the trade-offs.

Payments were expressed as ’one-off’ payments, in £ values for domestic customers and % of the annual bill for SME customers (with an illustration of the amount based on their reported current bill payment). The latter reflected the wide variation in bills across SMEs. The specific amounts followed the values tested in the LE 2013 study, with the addition of a £12 level requested by Electricity North West to add granularity.

Attribute selection

The selection of attributes for inclusion in the CE was developed in consultation with Electricity North West and focused on the levels that were of most relevance to their operational experience. This required a focus on frequency of outages as well as duration and the impact of advanced warning for planned outages.

To simplify the exercise, respondents were asked to think of the trade-offs in terms of outages occurring at the most inconvenient time of day and day of the week, eg when they are at home and most dependent on supply. This negated the need to include time of day or day of week in the exercise but obviously set the VoLL potentially at its highest value. The argument for this is that distribution network operators (DNOs) do not develop their infrastructure specifically to respond to variations in VoLL over time of day, day of week or time of year. Instead they have to plan for the worst case.

Two waves of research were conducted, one in winter and one in summer, so that time of year could also be controlled for. The final set of attributes used in the study are shown in Figure 1.1 below, alongside the attributes and levels tested in the LE 2013 study.

Figure 1.1 Domestic variables tested in the CE

	London Economics (2013)	This study (2017)	
		Planned	Unplanned
Duration of interruption	20 mins 1 hour 4 hours (5 for SMEs)	• 1 hour • 6 hours • More than 6 hours	• Up to 3 minutes • 1 hour • 6 hours • More than 6 hours • Major storm/flood causing a power cut lasting 2-3 days
Frequency of outages *(in a three year period)*	Not included	• 1 power cut • 2-3 power cuts • 4-6 power cuts • 7 or more power cuts	• 1 power cut • 2-3 power cuts • 4-6 power cuts • 7-14 power cuts • 15 or more power cuts
Advanced warning *(planned only)*	Not included	• 7 to 14 days' notice and a reminder 12 to 48 hours before we switch off your electricity • 14 days' notice • 7 days' notice • 48 hours' notice	Not applicable
Season	Not winter Winter	Conducted in winter Repeated in summer	Conducted in winter Repeated in summer
Time of day	Peak 3pm-9pm Non-peak 10pm-2pm	Not included	Not included
Day of week	Weekday Weekend/bank holiday (SMEs work day, Non-work day)	Not included	Not included
WTP/ WTA (domestic)	£1 £5 £10 £15	£1 £5 £10 £12 £15	£1 £5 £10 £12 £15
WTP/ WTA (SME)	1% 5% 10% 15%	1% 5% 10% 12% 15%	1% 5% 10% 12% 15%

This was the final set of attributes developed for the main body of the research, but prior to this a substantial pilot study was conducted using most of the attributes that were covered in the LE 2013 study. This is reported in Annex 1.1: Pilot study.

1.4 Generating choice cards for the experiment

Development of the experimental design

The potential number of attribute combinations was 240 for 'planned' outages (4 advanced warning x 4 frequency x 3 duration x 5 price) but only 125 for 'unplanned' outages (5 frequency x 5 duration x 5 price). As these numbers are far in excess of what an individual respondent could realistically assess, numerous 'sets' or blocks of six combinations were generated using an experiment design algorithm designed for this purpose[2].

Guidance in the literature[3] suggests that the minimum number of total combinations that should be used is:

$$3(K - k + 1)$$

Where: K = Total number of attribute levels
k = Total number of attributes

This is recommended to ensure sufficient degrees of freedom required for reliable parameter estimation. In the case of this study, this indicated a minimum of 33 combinations for planned outages ($3 \, * \, ((4 + 4 + 3 + 5) - 4 + 1)$) and also a minimum of 33 combinations for unplanned outages ($3 \, * \, ((5 + 5 + 5) - 3 + 1)$). These minima and maxima (33 to 240 for planned and 33 to 125 for unplanned) indicated some flexibility in the number of combinations that could be used for this survey.

With this in mind, domestic respondents saw one block of six scenarios drawn randomly from a design containing 27 blocks (27 for planned and 27 for unplanned), a total of 162 pairs (27 x 6), 324 combinations (162 x 2), though some of the combinations would be repeated across the design. The number of combinations was sufficient to give robust statistical properties (balanced frequency of attribute levels, low correlations between attributes, broad variation for a large and diverse sample of n=4,500), while ensuring that the number of blocks was low enough for practical field management.

For SME respondents, a smaller design was constructed, using nine blocks with six scenarios in each. This produced 54 pairs (9 x 6), 108 combinations (54 x 2). This reflected the smaller sample sizes for this group (n=1,500 in total) and an expectation of greater homogeneity in their preferences.

The main properties of the statistical designs are summarised in Annex 1.2: Statistical designs. A key aspect of the design was to avoid pairs where the choice was obvious to the respondent – for example, if one option was inferior in terms of both outage duration and frequency, price to pay would be lower (or compensation higher) than for the other option.

Sample sizes

The ability of the data to support robust models will not only depend on the efficiency of the design but also the amount of data (respondents) collected. Guidance on minimum sample sizes for analysis is given by the formula[4]:

$$N \; > \; 500c/(t \, * \, a)$$

Where: N = minimum sample for analysis
c = highest number of attribute levels in any one attribute
t = number of choice tasks seen by each respondent
a = number of alternatives in each choice task.

This indicates a minimum figure of about n=200 (500 * 5/(6 *2)) respondents for robust sub-group analysis. Figures 1.2a and 1.2b below show the sample sizes and observations obtained for each design, split by customer type and time of year.

2 Sawtooth SSI Web
3 Orme, 2010, Proceedings of the Sawtooth Software Conference, chapter 7
4 Ibid

Figure 1.2a: Sample sizes by design category

Customer type	Time of year	Payment context	Design type	
			Planned	Unplanned
Domestic	Winter	WTP	830	1620
		WTA	830	1620
	Summer	WTP	757	1761
		WTA	757	1761
SME	Winter	WTP	241	319
		WTA	241	319
	Summer	WTP	184	296
		WTA	184	296
Total domestic			**1587**	**3381**
Total SME			**425**	**615**

Given the guidelines on minimum sample sizes, there is sufficient data in each of these cells for analysis, though the scope for breaking down the SME sample into sub-groups is most limited. For modelling purposes, the data can be combined by time of year, on the basis that the context (time of the survey) is the only element that is varied.

Figure 1.2b: Observations by design category

Customer type	Time of year	Payment context	Design type	
			Planned	Unplanned
Domestic	Winter	WTP	4980	9720
		WTA	4980	9720
	Summer	WTP	4542	10566
		WTA	4542	10566
SME	Winter	WTP	1446	1914
		WTA	1446	1914
	Summer	WTP	1104	1776
		WTA	1104	1776
Total domestic			**9522**	**20286**
Total SME			**2550**	**3690**

The discrete choice exercise

Figures 1.3 and 1.4 below give examples of how the discrete choice scenarios were presented to respondents. SME respondents were shown the bill change in both percentage terms and actual monetary terms, based on their stated current bill level multiplied by the percentage value change.

Each respondent saw six WTP scenarios and six WTA scenarios, the order being randomised across respondents, so that half saw WTP first and half saw WTA first. Introductory screens before each block of six ensured that they were aware of the different question being asked. A 'least counts' procedure was used to ensure that the blocks within each design were evenly distributed across the sample.

Figure 1.3: Example 'main' scenario for domestic customer (planned outage – WTP)

Below are descriptions of two power cuts involving different scenarios. Please select the one that most accurately reflects your view on the amount of money *you would be prepared to pay* to avoid this situation from happening.

Please remember this is only a hypothetical situation and payment:

WTP	Option A	Option B	
Advance warning of the power cut/s	7 days notice	14 days notice	Not sure
Frequency of power cuts/s (over a three-year period)	1 power cut	7 or more power cuts	
Duration of the power cut/s	6 hours per power cut	1 hour per power cut	
The amount you pay to avoid this happening	Cost to you: £5	Cost to you: £10	
Please make your selection here	○	◉	○

Figure 1.4: Example 'main' scenario for SME customer (unplanned outage – WTA)

Below are descriptions of two power cuts involving different scenarios. Please select the one that most accurately reflects your view on what you *would expect to receive* to accept this situation.

Please remember this is only a hypothetical situation and payment:

WTA	Option A	Option B	
Frequency of power cuts/s (over a three-year period)	7-14 power cuts	4-6 power cuts	Not sure
Duration of the power cut/s	More than 6 hours per power cut	6 hours per power cut	
The amount you receive for this happening	Payment to you: 15% of your annual electricity bill	Payment to you: 5% of your annual electricity bill	
Please make your selection here	○	◉	○

A secondary discrete choice exercise ('mitigation initiatives')

A separate but related objective of the research was to understand how certain initiatives by a DNO could potentially mitigate VoLL by reducing the disutility of outages. A separate discrete choice exercise was developed for this, but a concern arose that the respondents' evaluation of these mitigating initiatives would be too abstract if not placed in the context of specific outage examples. The decision was therefore made to inter-leave the scenarios of this second exercise among each of the scenarios of the main discrete choice exercise, so that the initiatives could be assessed immediately in the context of what they had chosen with regard to a specific outage scenario.

This is a novel approach in the measurement of WTP/WTA in the utilities sector, though such 'inter-leaved' approaches are not without precedence in other sectors[5]. A potential criticism is that the presence of the secondary 'mitigation' scenarios could have some non-systematic influence on the response to the main WTA/WTP scenarios, either by introducing the notion that the dis-benefits of outages could be partially mitigated and more generally, adding to the cognitive burden of the overall exercise. On the other hand, a potential benefit is that these scenarios break the monotony of the choices – an issue that is often cited by respondents when completing discrete choice experiments.

Although the secondary discrete choice exercise was constructed from a completely separate design, the blocks of six secondary scenarios that appeared with each set of WTA/WTP scenarios were selected so as to keep correlations between the main attributes and the mitigation attributes to a minimum. This way, the main discrete choice exercise worked independently (in statistical terms) from the secondary exercise.

Careful piloting with face-to-face interviews suggested that most respondents understood the exercise and were able to complete the choices without difficulty.

Annex 1.4 provides more detail on the secondary discrete choice exercise.

2 AGGREGATE MULTINOMIAL LOGIT MODEL

2.1 Why estimate aggregate models?

An interim step in the analysis

The main approach to the analysis of the discrete choice exercises was to be a Hierarchical Bayesian (HB) approach, designed to estimate values for individual respondents. Compared to more traditional aggregate models, this approach has the potential to draw out differences in the VoLL of different sub-groups of customers more clearly. In this case, aggregate models refers to models that do not recognise the characteristics of individual respondents or that the data contains repeated measures for each individual.

However, there is value in understanding how conventional multinomial logit model (MNL) models perform with this data. This allows a more direct comparison with the earlier London Economics VoLL work and a basis for comparing and contrasting the final HB results at the aggregate level.

Multinomial logit model

The MNL model is a widely used general model of choice behaviour based on the premise that consumers attach a 'utility' to each of the options available to them and that they choose the option with the highest utility. The model relates to probability of choice and the utility function represented in the model will therefore have a systematic component (representing, for example, the features of the options that appeal to or deter the consumer) and a random component:

5 Pinnel, J (IntelliQuest), 1994, Multistage Conjoint Methods to Measure Price Sensitivity, Sawtooth.
SKIM, Adaptive Choice-Based Conjoint analysis (ACBC) - https://skimgroup.com/methodologies/adaptive-choice-based-conjoint/

$$Uj = Vj + \varepsilon$$

Where: Uj = Utility of option j
Vj = The systematic component of the choice of option j
ε = The random element of the choice of option j

If the random component is assumed to have an extreme value 1 exponential distribution[6], the model takes the following basic MNL form:

$$Pj = \frac{\exp(Vj)}{\sum_1^k \exp(Vk)}$$

Where: Pj = Probability of choosing option j
Vj, Vk = Utility function for each option

It is a necessary assumption in the MNL model that the odds of choosing alternative j over alternative k should be independent of the choice set for all pairs j,k (the independence of irrelevant alternatives).

The logistic regression element of the statistical package for the social sciences (SPSS) analysis package was used to estimate these models. The data is panel data, where all choices that were presented to respondents are stacked. Each respondent provided 18 lines of data (6 scenarios x 3 choices). As indicated above, the estimation procedure makes no recognition of individual respondent characteristics.

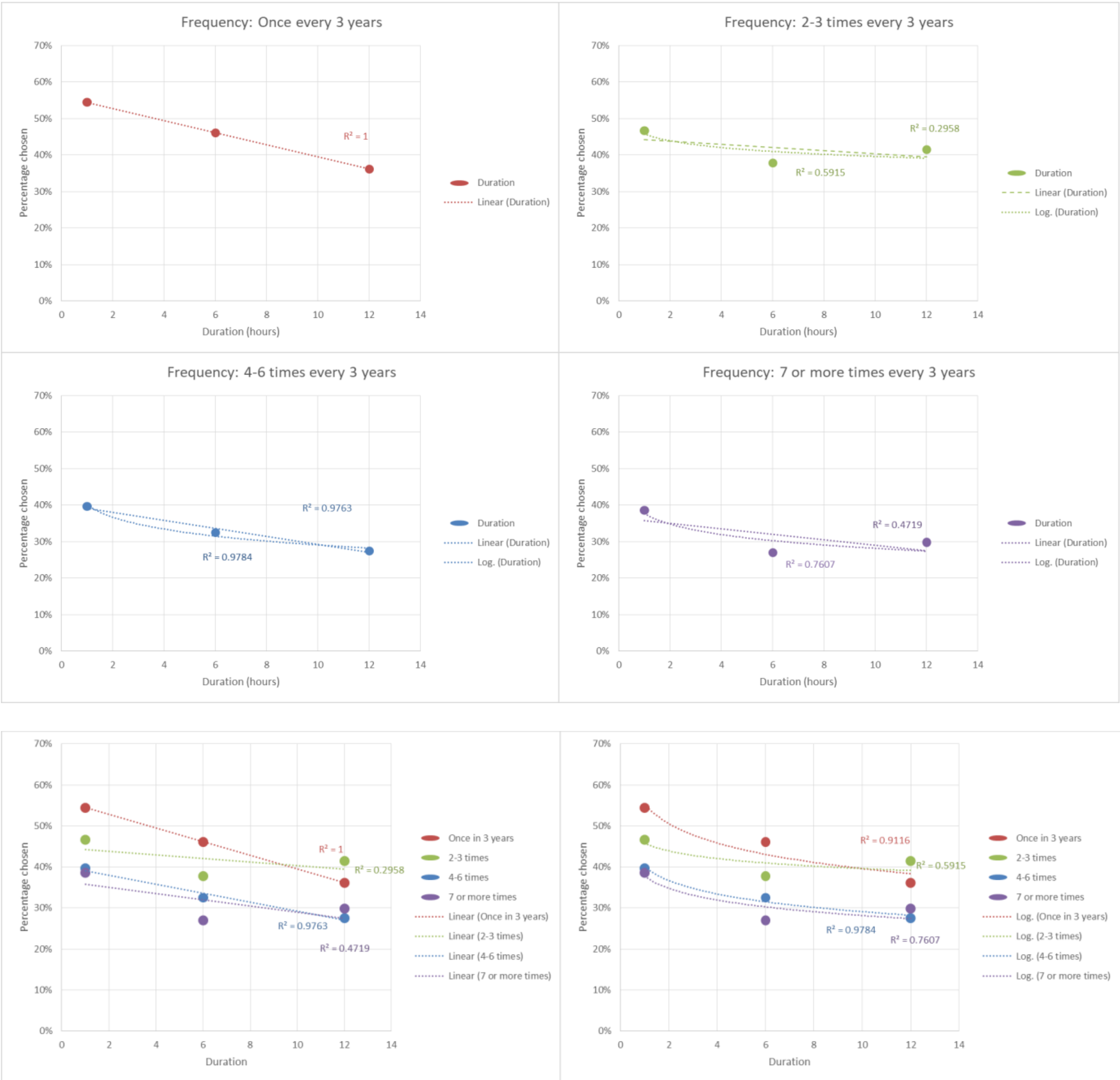
Determining the functional form of the models

Duration and frequency

Figures 2.1 – 2.8 show the relationship between each of the attribute levels tested for duration and frequency in the CE and the percentage of choices in favour of one discrete option over another. This information illustrates the underlying relationships in the data. It is logical to expect the percentage choice to decline as duration and or frequency of outage increases and the purpose is to confirm that respondent behaviour is as anticipated.

6 $Prob(\epsilon) = \exp(-\exp(-\varepsilon))$

Figure 2.1: Percentage choice by duration and frequency – <u>domestic planned – willingness to pay</u>



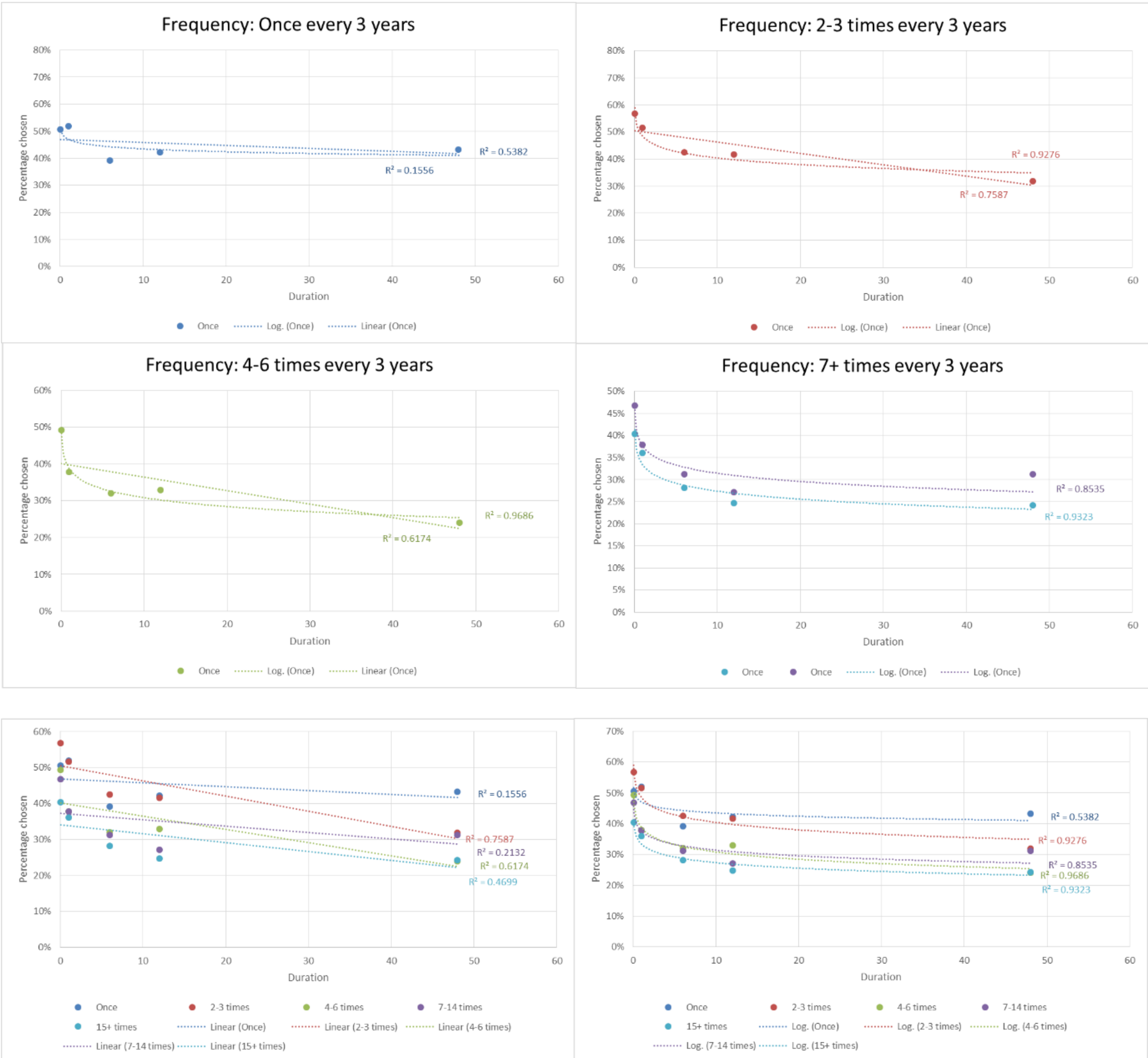
These plots suggest that a linear representation of duration varies widely in terms of fit, but for events more frequent than once per year, a non-linear (logarithmic) representation is appropriate, especially for events occurring 2-3 times in three years. There is no strong suggestion of a possible interaction effect between duration and frequency and a fair amount of inconsistency (the percentage chosen results are not in the expected order for 12 hours, compared to those observed for one hour and six hours).

Figure 2.2: Percentage choice by duration and frequency – <u>domestic planned – willingness to accept</u>

These plots suggest that a linear representation of duration fits well, but for more frequent events, a non-linear (logarithmic) representation could be more appropriate, especially for events occurring 2-3 times in three years. There is a suggestion of a possible interaction effect between duration and frequency:

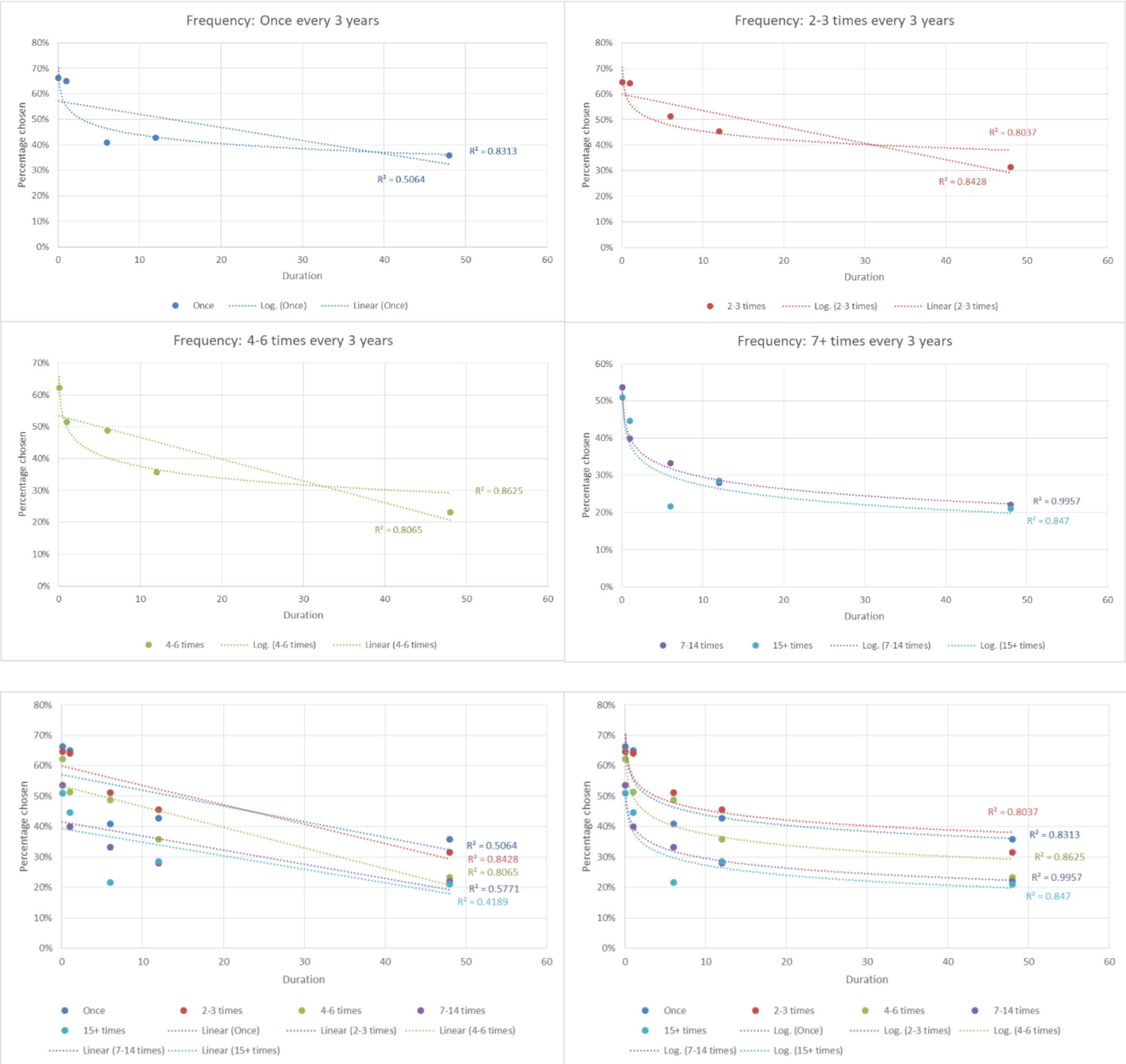
- At one-hour duration, choice percentage only declines when frequency is four or more times in three years and does not decline further
- At six hours duration, choice declines immediately when frequency is 2-3 times in three years and then less so for more frequent events
- At 12 hours duration, the decline in choice is more regularly in line with increases in frequency.

Figure 2.3: Percentage choice by duration and frequency – <u>domestic unplanned – willingness to pay</u>



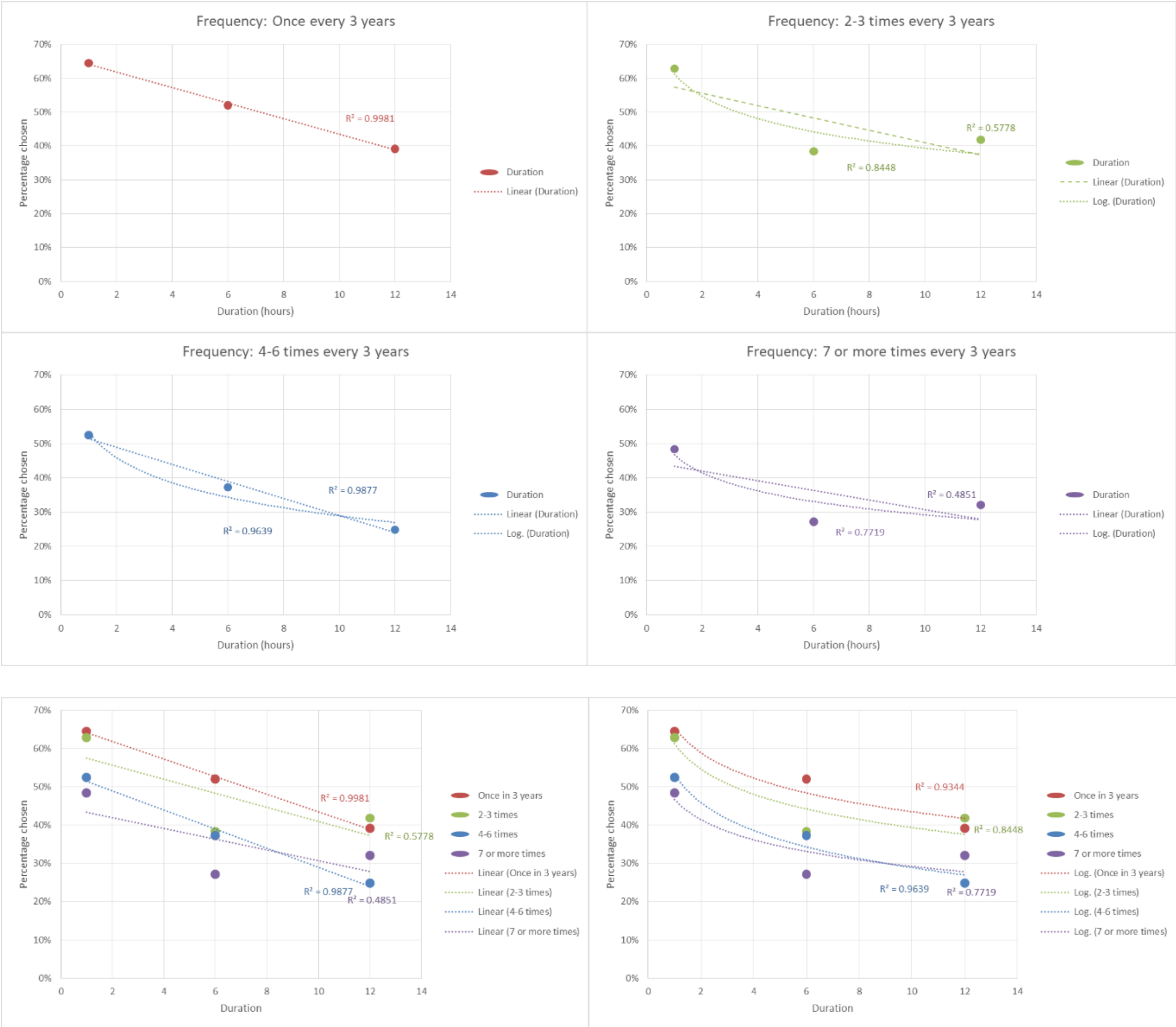
These plots suggest that a linear representation of duration varies widely in terms of fit and that a non-linear (logarithmic) representation is appropriate. There is a fair amount of inconsistency in how duration relates to frequency (the percentage chosen results are not in the expected order for 12 hours, compared to those observed for one hour and six hours).

Figure 2.4: Percentage choice by duration and frequency – <u>domestic unplanned – willingness to accept</u>



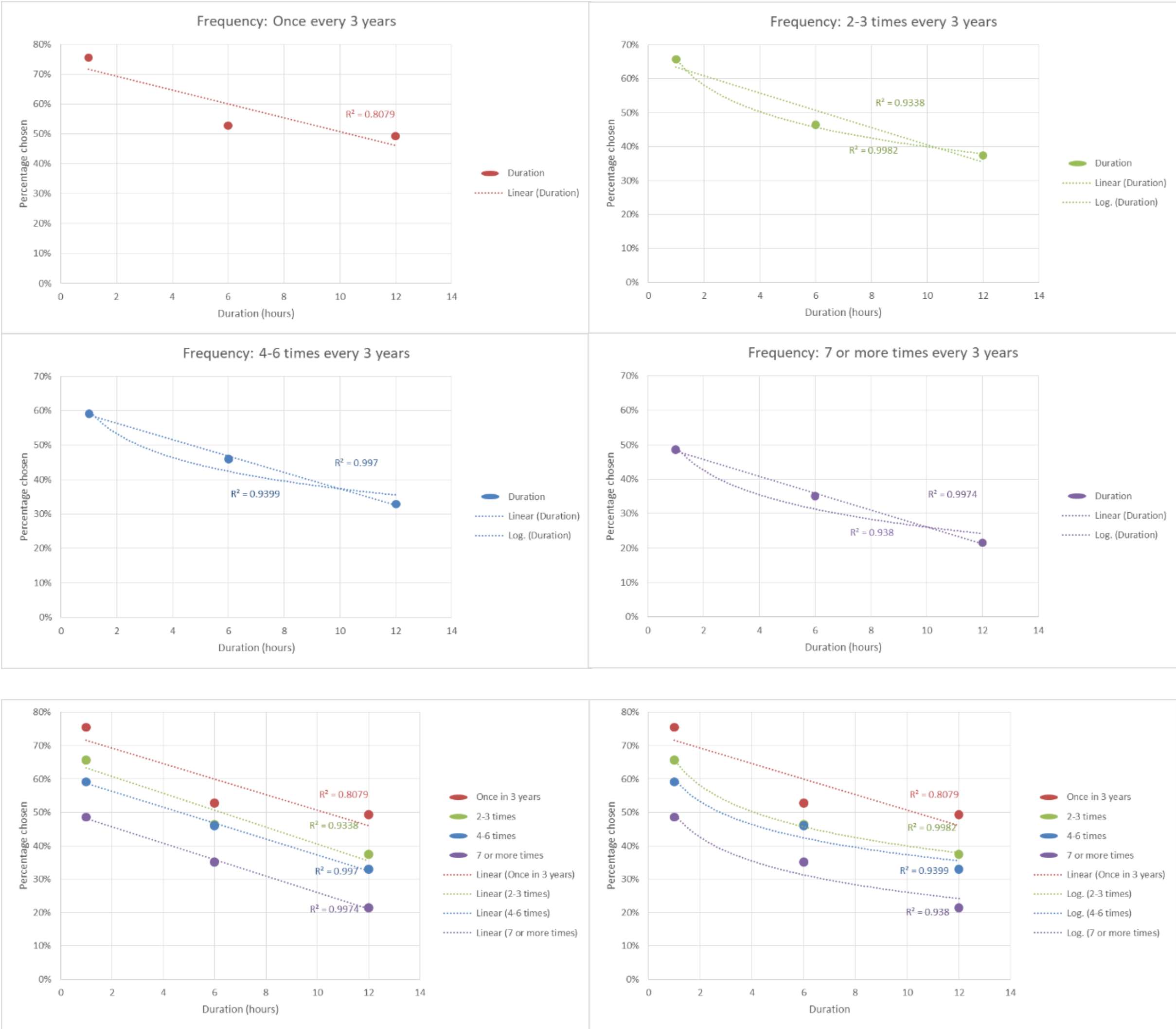
These plots suggest that a non-linear (logarithmic) representation of duration fits notably better than a linear representation. There also appears to be very little difference between frequency of ‘once in three years’ and frequency of ‘2-3 times in three years’.

Figure 2.5: Percentage choice by duration and frequency – <u>SME planned – willingness to pay</u>



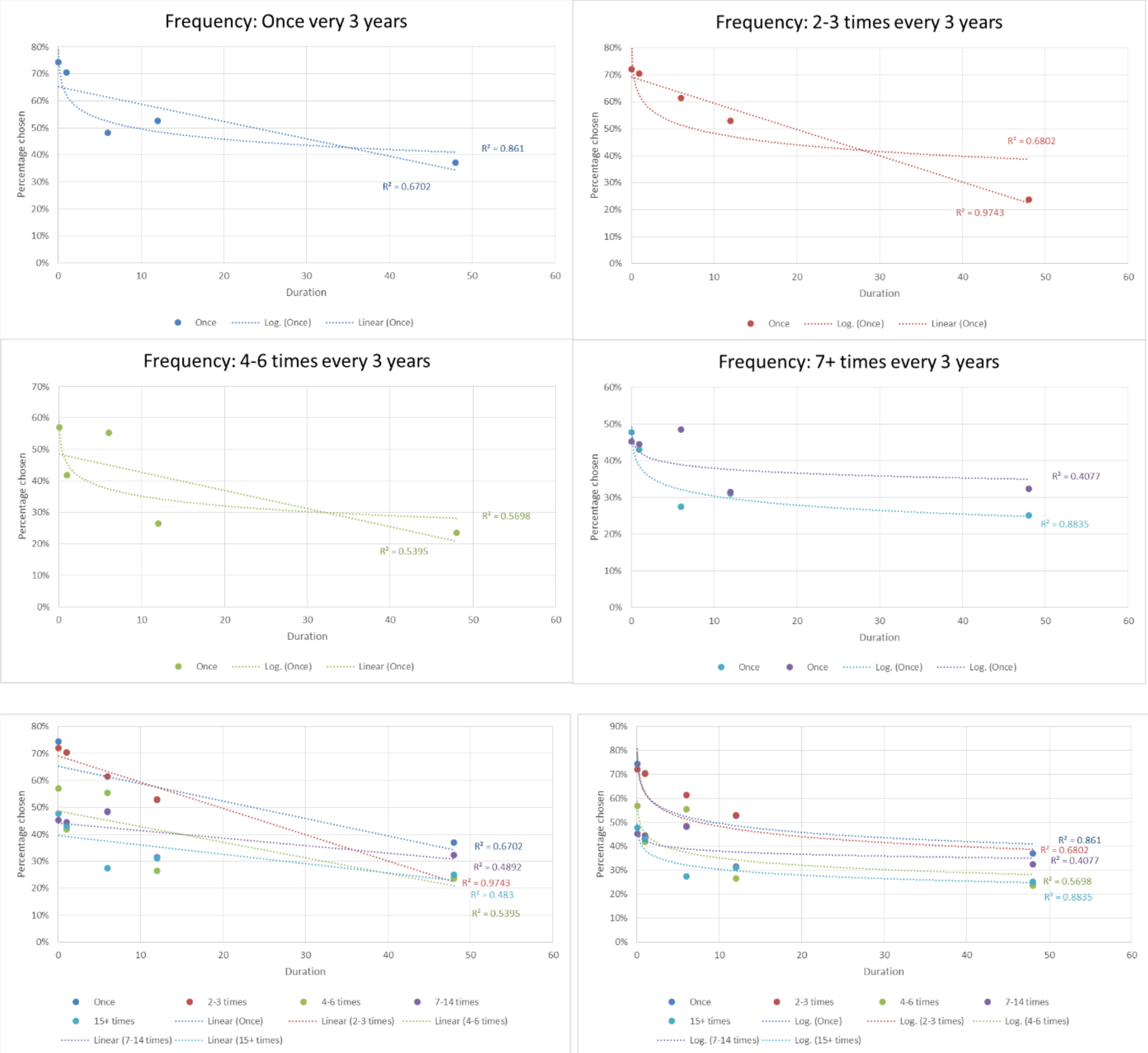
These plots suggest that a linear representation of duration varies widely in terms of fit, but for events more frequent than once per year, a non-linear (logarithmic) representation is appropriate, especially for events occurring 2-3 times in three years. There is a fair amount of inconsistency in how duration relates to frequency (the percentage chosen results are not in the expected order for 12 hours, compared to those observed for one hour and six hours).

Figure 2.6: Percentage choice by duration and frequency – <u>SME planned – willingness to accept</u>



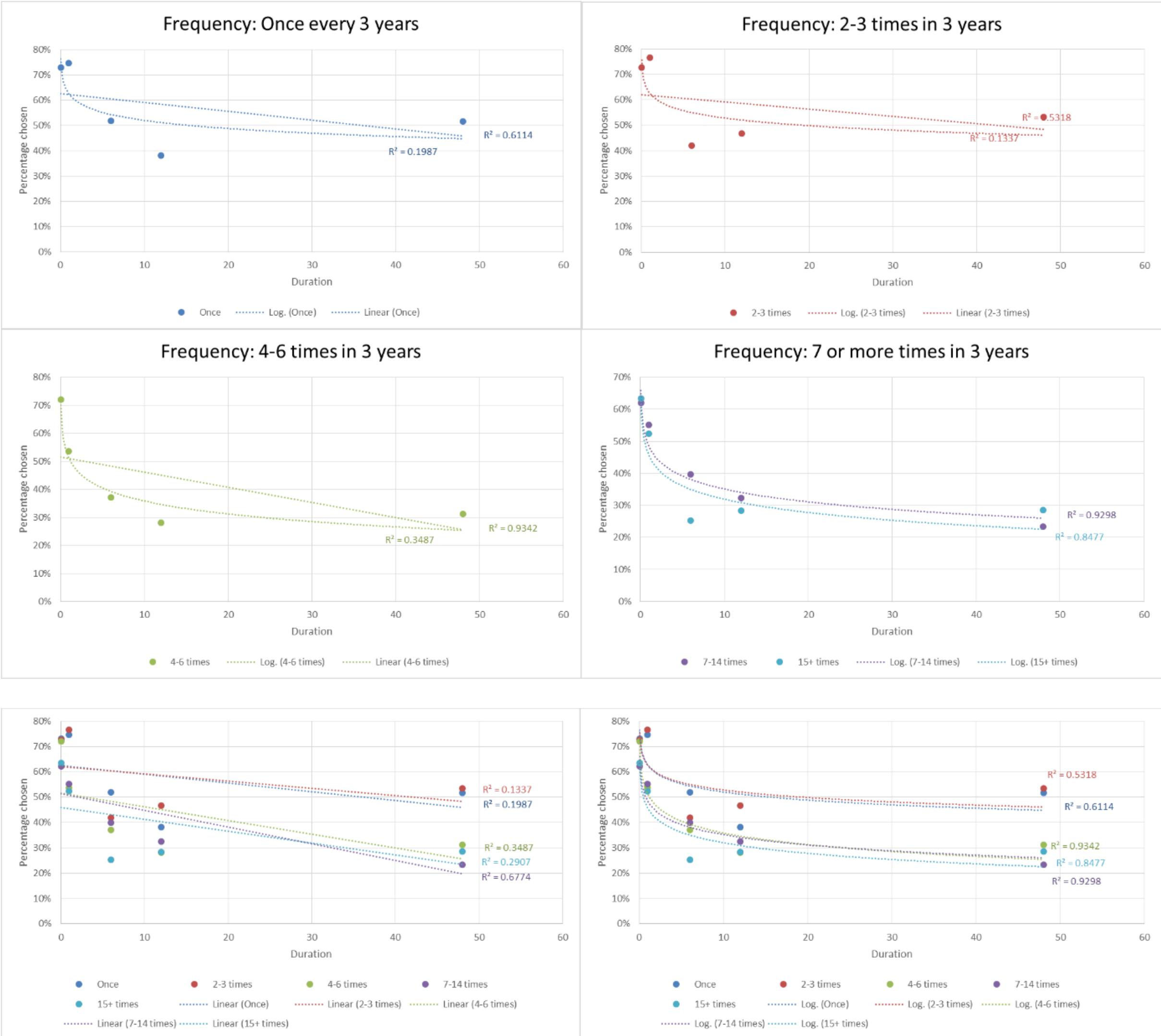
These plots suggest that a linear representation of duration fits well, but for more frequent events, a non-linear (logarithmic) representation is more appropriate, especially for events occurring 2-3 times in three years.

Figure 2.7: Percentage choice by duration and frequency – <u>SME unplanned – willingness to pay</u>



These plots suggest that a linear representation of duration varies widely in terms of fit and that a non-linear (logarithmic) representation is more appropriate. There is a fair amount of inconsistency in how duration relates to frequency (the percentage chosen results are not in the expected order for 12 hours and 48 hours, compared to those observed for one hour and six hours).

Figure 2.8: Percentage choice by duration and frequency – <u>SME unplanned – willingness to accept</u>

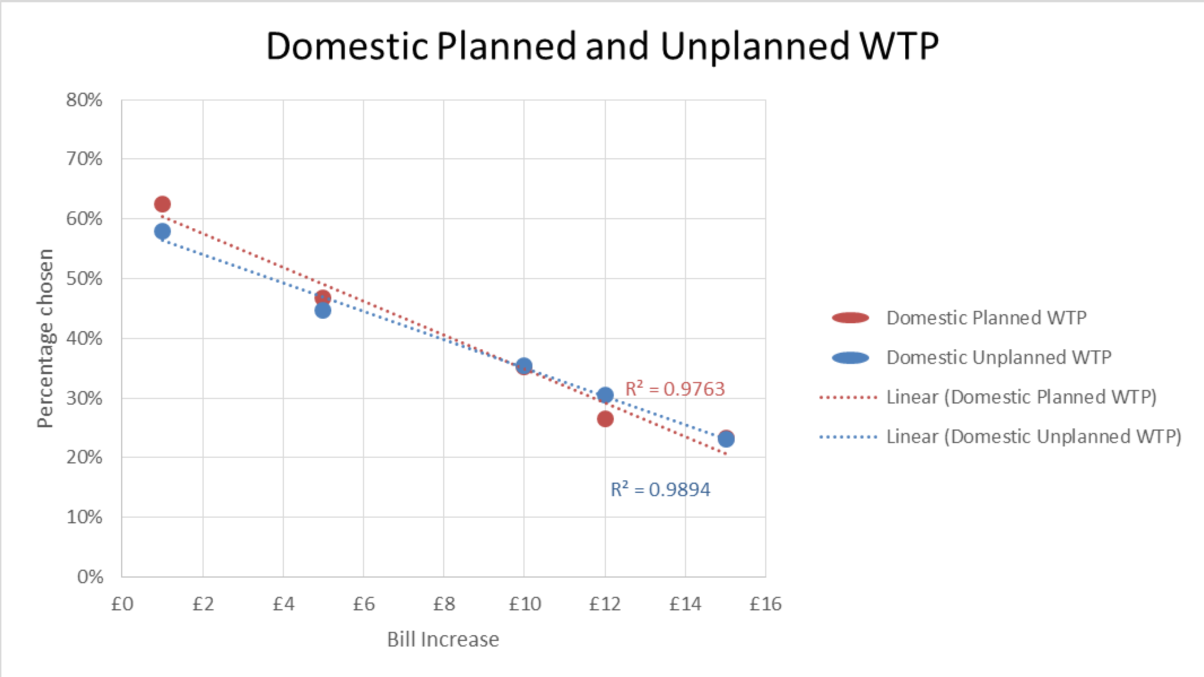


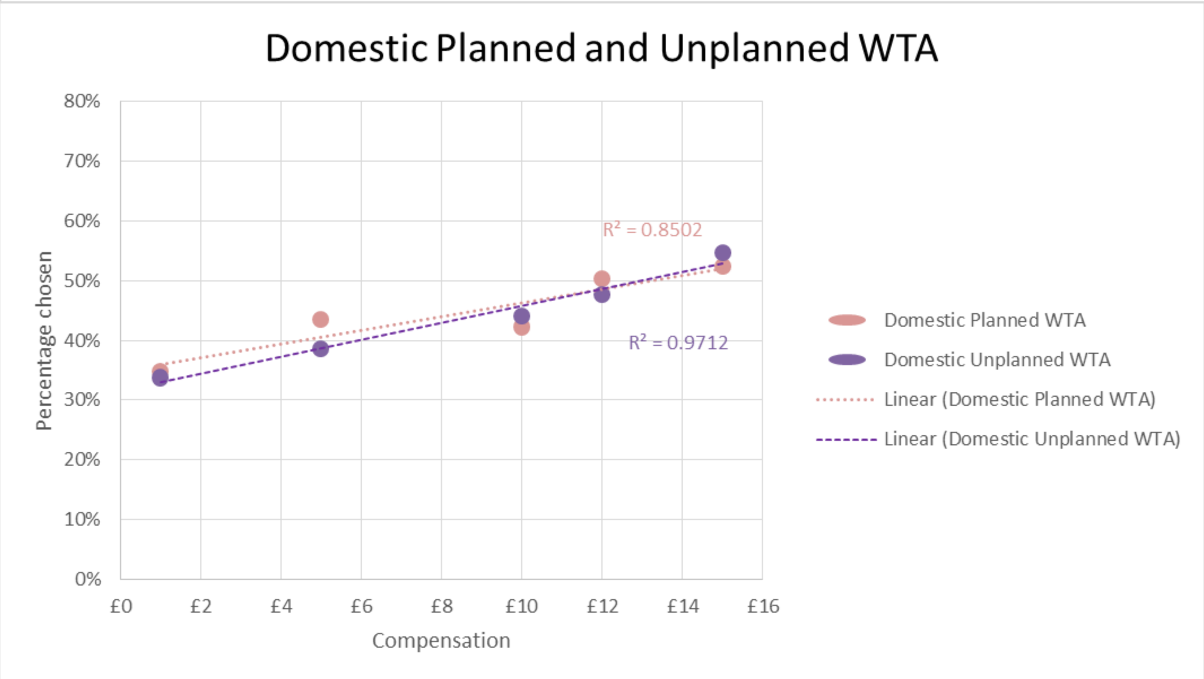
These plots suggest that a non-linear (logarithmic) representation of duration fits notably better than a linear representation. There also appears to be very little difference between frequency of 'once in three years' and frequency of '2-3 times in three years'.

Price

Figures 2.9 and 2.10 plot the relationship of the 'price' attribute ('bill increase' for WTP and 'compensation' for WTA).

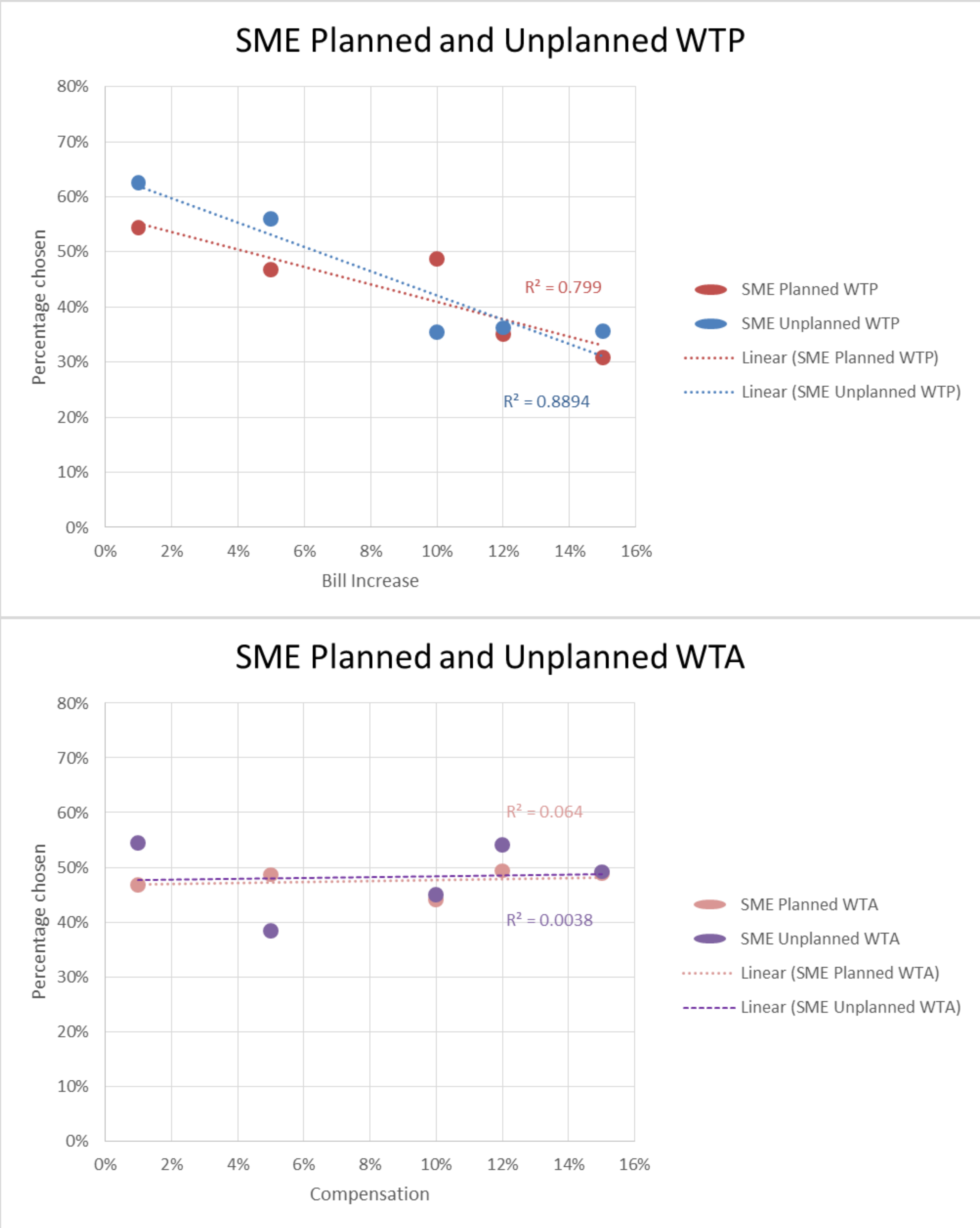
Figure 2.9: Percentage choice by price – Domestic planned and unplanned, WTP and WTA





Plots of percentage chosen against price shows strong linear relationships for all domestic groups.

Figure 2.10: Percentage choice by price – <u>SME planned and unplanned, WTP and WTA</u>



Plots of percentage chosen against price shows a relatively strong linear relationship for SME WTP results, but for SME WTA the results suggest minimal relationship between price and percentage chosen. This clearly suggests that over the range of WTA values tested in this study, no compensation is sufficient to offset outages for SMEs.

Logistic regression models

For consistency across all the models, the attribute levels were coded as follows:

- Duration – indexed units, where '3 mins' = 1, '1 hour' = 20, '6 hours' = 120, 'More than 6 hours' = 240 and '2-3 days' = 48 hours = 960[7].
- Frequency – 'dummy' (0,1) for each level above 'Once in 3 years'
- Price – pounds sterling (domestic)/% change in bill (SME)
- Warning[8] – days in advance, where '7 to 14 days notice' = 10.5, '14 days notice' = 14, '7 days notice' = 7 and '48 hours notice' = 2.

Based on the analysis reported in the preceding tables:

- For the 'planned' models, all parameters were represented as linear
- For 'unplanned' models, duration was represented by the natural log of the index value; frequency and price were represented as linear
- Frequency was represented by dummy (0,1) values multiplied through by duration
- Price was represented as bill increases in the WTP form of the model and as compensation payments in the WTA form of the model
- These approaches applied equally to domestic and SME models.

The utility functions were therefore defined as:

Planned

$$Uj = a0 + b1j * duration + b2j * (duration * freq2 - 3) + b3j * (duration * freq4 - 6) + b4j * (duration * freq7 +) + b5j * warning + cj * price + d * (don't\ know)$$

Unplanned

$$Uj = a0 + b1j * \ln(duration) + b2j * (\ln(duration) * freq2 - 3) + b3j * (\ln(duration) * freq4 - 6 + b4j * \ln duration * freq7 - 14 + b5j * \ln duration * freq15 + + cj * price + d * (don't\ know)$$

The constant $a0$ is there to detect any potential left/right bias and parameter d represents the 'don't know' option.

The WTP and WTA values are calculated by summing the coefficients b1 to b5, as they apply, and dividing through by the coefficient c (price)[9]. Standard errors or the WTP and WTA were calculated from the variance (standard error ^ 2) of the model coefficients, applying the 'delta method', as used in the LE study for the same purpose[10].

A final step in the calculations is to divide the WTP/WTA estimate through by the average domestic hourly usage in MW to give a VoLL in MWh.

The model specification was selected from a number of alternatives, reported in Annex 1.3.

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7 This was consistent with the coding used in the LE study. '3 mins' and '2-3 days' only apply to unplanned outages
8 Only applicable to planned outages
9 For a full derivation of this method, refer to London Economics, 2013, The Value of Lost Load (VoLL) for Electricity in Great Britain, p100-101
10 London Economics, 2013, The Value of Lost Load (VoLL) for Electricity in Great Britain, p17

Figure 2.11: Logistic regression results – domestic planned – willingness to pay

Sample size	N=1,587, Obs = 28,566		
	B	SE	Sig.
duration (20,120,240)	-.001	.000	.000
duration * freq2_3 (2-3 times in 3 years)	-.001	.000	.000
duration * freq4_6 (4-6 times in 3 years)	-.003	.000	.000
duration * freq7+ (7 or more times in 3 years)	-.004	.000	.000
Warning	.009	.004	.009
Price (compensation)	-.129	.003	.000
Don’t know	-2.233	.056	.000
Constant	.907	.051	.000
Nagelkerke R Square		14.8	
Correct classification overall (%)		70.5	

WTP estimate for a one-hour outage:	£0.15 (-0.001 * 20/-0.129)
Standard error of WTP:	£0.08
VoLL equivalent for 1 MWh:	**£327** (£0.15/0.00045, where 0.00045 is average domestic usage per hour)
Confidence interval (95%):	£154 – £500

Figure 2.12: Logistic regression results – Domestic planned – willingness to accept

Sample size	N=1,587, Obs = 28,566		
	B	SE	Sig.
duration (20,120, 240)	-.002	.0002	.000
duration * freq2_3 (2-3 times in 3 years)	-.003	.0003	.000
duration * freq4_6 (4-6 times in 3 years)	-.004	.0003	.000
duration * freq7+ (7 or more times in 3 years)	-.006	.0003	.000
Warning	.010	.003	.004
Price (compensation)	.048	.003	.000
Don’t know	-2.150	.056	.000
Constant	-.029	.045	.520
Nagelkerke R Square	25.1		
Correct classification overall (%)	72.5		

WTA estimate for a one-hour outage:	£0.99 (-002 * 20/0.048)
Standard error of WTP:	£0.22
VoLL equivalent for 1 MWh:	**£2,208** (£0.99/0.00045, where 0.00045 is average domestic usage per hour)
Confidence interval (95%):	£1,717 – £2,698

Figure 2.13: Logistic regression results – Domestic unplanned – willingness to pay

Sample size	N=3,381, Obs = 60,858		
	B	**SE**	**Sig.**
Ln(duration) (1,20,120,240,960)	-.049	.006	.000
Ln(duration) * freq2_3 (2-3 times in 3 years)	-.030	.007	.000
Ln(duration) * freq4_6 (4-6 times in 3 years)	-.077	.007	.000
Ln(duration) * freq7-14 (7 to 14 times in 3 years)	-.092	.007	.000
Ln(duration) * freq15+ (15 or more times in 3 years)	-.123	.007	.000
Price (compensation)	-.101	.002	.000
Don't know	-1.964	.032	.000
Constant	.804	.027	.000
Nagelkerke R Square	10.5		
Correct classification overall (%)	69.7		

WTP estimate for a one-hour outage:	£1.45 (-0.049 * Ln(20)/-0.101)
Standard error of WTP:	£0.36
VoLL equivalent for 1 MWh:	**£3,213** (£1.45/0.00045, where 0.00045 is average domestic usage per hour)
Confidence interval (95%):	£2,414 – £4,012

Figure 2.14: Logistic regression results – domestic unplanned – willingness to accept

Sample size	N=3,381, Obs = 60,858		
	B	**SE**	**Sig.**
Ln(duration) (1,20,120,240,960)	-0.155	0.006	0.000
Ln(duration) * freq2_3 (2-3 times in 3 years)	0.006	0.007	0.417
Ln(duration) * freq4_6 (4-6 times in 3 years)	-0.024	0.007	0.001
Ln(duration) * freq7-14 (7 to 14 times in 3 years)	-0.116	0.007	0.000
Ln(duration) * freq15+ (15 or more times in 3 years)	-0.135	0.007	0.000
Price (compensation)	0.064	0.002	0.000
Don't know	-1.920	0.021	0.000
Nagelkerke R Square	32.6		
Correct classification overall (%)	71.8		

WTA estimate for a one-hour outage: £7.32 (-0.155 * Ln(20)/0.064)

Standard error of WTP: £0.33

VoLL equivalent for 1 MWh: **£16,257** (£7.32/0.00045, where 0.00045 is average domestic usage per hour)

Confidence interval (95%): £14,838 – £17,677

Figure 2.15: Logistic regression results – <u>SME planned – willingness to pay</u>

Sample size	N=425, Obs = 7,650		
	B	SE	Sig.
duration (20,120,240)	-.001	.001	.066
duration * freq2_3 (2-3 times in 3 years)	-.001	.001	.027
duration * freq4_6 (4-6 times in 3 years)	-.004	.001	.000
duration * freq7+ (7 or more times in 3 years)	-.003	.001	.000
Warning	.036	.006	.000
Price (% bill increase)	-.047	.006	.000
Don't know	-2.140	.089	.000
Constant	.143	.060	.017
Nagelkerke R Square	19.0		
Correct classification overall (%)	68.1		

WTP estimate for a one-hour outage:	£10.83 ((-0.001 * 20/-0.047) * £2,500/100, where £2,500 is the average annual bill)
Standard error of WTP:	£11.87
VoLL equivalent for 1 MWh:	**£3,222** (£10.83/0.0033597, where 0.0033597 is average SME usage per hour)
Confidence interval (95%):	£0 – £6,755

Figure 2.16: Logistic regression results – <u>SME planned – willingness to accept</u>

Sample size	N=425, Obs = 7,650		
	B	**SE**	Sig.
duration (20,120,240)	-.002	.000	.000
duration * freq2_3 (2-3 times in 3 years)	-.002	.001	.000
duration * freq4_6 (4-6 times in 3 years)	-.003	.001	.000
duration * freq7+ (7 or more times in 3 years)	-.006	.001	.000
Warning	.036	.007	.000
Price (% bill compensation)	.012	.006	.067
Don't know	-3.086	.116	.000
Constant	.056	.057	.324
Nagelkerke R Square		31.9	
Correct classification overall (%)		67.6	

WTA estimate for a one-hour outage:	£94.31 ((-0.002 * 20/0.012) * £2,500/100, where £2,500 is the average annual bill)
Standard error of WTP:	£108.83
VoLL equivalent for 1 MWh:	**£28,071** (£94.31/0.0033597, where 0.0033597 is average SME usage per hour)
Confidence interval (95%):	£0 – £60,464

Figure 2.17: Logistic regression results – SME unplanned – willingness to pay

Sample size	N=615, Obs = 11,070		
	B	SE	Sig.
Ln(duration) (1,20,120,240,960)	-.107	.015	.000
Ln(duration) * freq2_3 (2-3 times in 3 years)	-.035	.016	.031
Ln(duration) * freq4_6 (4-6 times in 3 years)	-.080	.017	.000
Ln(duration) * freq7-14 (7 to 14 times in 3 years)	-.111	.016	.000
Ln(duration) * freq15+ (15 or more times in 3 years)	-.149	.017	.000
Price (% bill increase)	-.084	.005	.000
Don't know	-3.529	.086	.000
Constant	1.257	.064	.000
Nagelkerke R Square	27.6		
Correct classification overall (%)	73.9		

WTP estimate for a one-hour outage:	£95.30 ((-0.107 * Ln(20)/-0.084) * £2,500/100, where £2,500 is average annual bill)
Standard error of WTP:	£27.99
VoLL equivalent for 1 MWh:	**£28,367** (£95.30/0.0033597, where 0.0033597 is average domestic usage per hour)
Confidence interval (95%):	£20,036 – £36,698

Figure 2.18: Logistic regression results – SME unplanned – willingness to accept

Sample size	N=615, Obs = 11,070		
	B	SE	Sig.
Ln(duration) (1,20,120,240,960)	-.140	.014	.000
Ln(duration) * freq2_3 (2-3 times in 3 years)	-.016	.016	.344
Ln(duration) * freq4_6 (4-6 times in 3 years)	-.144	.017	.000
Ln(duration) * freq7-14 (7 to 14 times in 3 years)	-.149	.017	.000
Ln(duration) * freq15+ (15 or more times in 3 years)	-.193	.017	.000
Price (% bill compensation)	**-.013**	**.005**	**.012**
Don't know	-4.245	.111	.000
Constant	.981	.068	.000
Nagelkerke R Square	36.7		
Correct classification overall (%)	71.8		

WTA estimate for a one-hour outage: - (sign for price is counter-intuitive)

Standard error of WTP: - (sign for price is counter-intuitive)

Confidence interval (95%): - (sign for price is counter-intuitive)

The counter-intuitive results from the model reported in Figure 2.18 above is a concern. Reference to the second chart in Figure 2.10 shows that the percentage chosen when the compensation is +1% is high relative to the +5% and +10% values. This suggests that this small level of compensation is unlikely to be influencing choices but is instead being 'pulled' into this position by the strong influence of frequency and duration. The experimental design minimised correlation between attribute levels, but the requirement that no choices should be obvious (ie one option having longer duration and more frequent outages for less compensation) could allow this to occur. The apparent dominance of the duration and frequency attributes over this lowest level of compensation has the effect of making the price coefficient weak and the sign counter-intuitive (for WTA, it should be positive).

If the price parameter is fitted only to compensation of +5% or more, a stronger model results, as indicated in Figure 2.19 below. Here, the magnitude of the coefficients is greater and the fit improved. The confidence interval is correspondingly narrower.

Figure 2.19: Logistic regression revised results – SME unplanned – willingness to accept (see Figure 2.18)

Sample size	N=615, Obs = 9,553		
	B	SE	Sig.
Ln(duration) (1,20,120,240,960)	-.113	.015	.000
Ln(duration) * freq2_3 (2-3 times in 3 years)	.016	.019	.380
Ln(duration) * freq4_6 (4-6 times in 3 years)	-.109	.018	.000
Ln(duration) * freq7-14 (7 to 14 times in 3 years)	-.140	.019	.000
Ln(duration) * freq15+ (15 or more times in 3 years)	-.193	.019	.000
Price (% bill compensation) ***– 1% level omitted***	.058	.004	.000
Don't know	-3.264	.087	.000
Nagelkerke R Square	50.2		
Correct classification overall (%)	75.9		

WTA estimate for a one-hour outage: £147.11 (-0.113 * Ln(20)/0.058) * £2,500/100, where £2,500 is average annual bill)

Standard error of WTP: **£43,787** (£147.11/0.0033597 where 0.0033597 is average SME usage per hour)

Confidence interval (95%): £30,997 – £56,576

Review of VoLL estimations based on logistic regression

The VoLL derived from these models implies higher values for domestic customers than those observed in the LE study.

Figure 2.20: Summary of VoLL estimations – this study v LE study

Block			This study (logistic regression)		LE study (logistic regression)[11]	
			VoLL in MWh	95% Confidence Interval	Peak VoLL in MWh (Annual average 2013)	Value range[12]
Domestic	**Planned**	WTP	£327	£154 – £500		
		WTA	£2,208	£1,717 – £2,698		
	Unplanned	WTP	£3,213	£2,414 – £4,012	£968 (£978)	£430 – £1,500 *(£0 – £2,165)*
		WTA	£16,257	£14,838 – £17,677	£12,246 (£8,600)	£10,580 – £13,880 *(£4,638 – £15,235)*
SME	**Planned**	WTP	£3,222	£0 – £6,755		
		WTA	£28,071	£0 – £60,464		
	Unplanned	WTP	£28,367	£20,036 – £36,698	£23,442 (£22,822)	£330 – £78,910 *(£19,271 – £27,859)*
		WTA[13]	£43,787	£30,997 – £56,576	£35,726 (£37,637)	£10,360 – £61,090 *(£33,358 – £44,149)*

The values from the LE study correspond to unplanned outages as no reference was made to warnings in that study. The generally higher values of VoLL observed for this study may reflect differences in the way the two studies were conducted:

- The span of duration values tested in the LE study was narrower than in this study (20 minutes, one hour, four hours v thee minutes, one hour, six hours 12 hours and 48 hours)
- Frequency of outages was a variable; in the LE study it was fixed at ‘once every 12 years’; in this study, the lowest level of frequency was once every three years (judged

11 London Economics, 2013, The Value of Lost Load (VoLL) for Electricity in Great Britain, p109, p111. The VoLL figure here is an average of peak values for the whole year, encompassing winter / non-winter, weekend / weekday. The peak values have been chosen for comparison because the exercise in this study was presented to respondents in terms of the time when an outage would be of most inconvenience to them. The average for the whole year including off-peak is given in brackets.

12 The value range contains two sets of results taken from the LE study. The upper figures are 95% confidence intervals calculated from information provided in Tables 64/65, 70/71 of the LE report and are therefore an approximation. The lower figures in brackets are the lowest and highest values estimated across the variations of peak / off-peak, winter / non-winter, weekend / weekday. This serves to indicate the broad variability of the values.

13 Based on a price parameter where the smallest level of compensation (1%) has been omitted.

to be the current level of service for most DNOs) and a range of higher frequencies were also tested

- In this study, the context for the choices was the respondent’s most inconvenient time for when an outage occurs; in the LE study a variety of general time categories were tested: inter/non-winter, peak/off-peak, weekday/weekend
- The number of attributes that respondents had to consider in the CE was consequently lower in this study: three (duration, frequency, bill price) v five (duration, time of year, time of day, day of week, bill price)
- There is a period of five years between the two studies, so effects of inflation would be expected, representing an overall increase of around10%, reflective of inflation of approximately +10% in the UK over that period.

These results suggest a significant difference for domestic consumers when compared to the earlier LE study. The confidence intervals for this study do not include the LE estimates. As indicated in the above statements, the results for this study reflect the ‘worst case scenario’ for customers, unlike the LE study that examined a range of less specific events (variations by time of day, day of week, time of year) and lower impact events (no outages over four hours and a reduced frequency: no more than once every 12 years).

3 HIERARCHICAL BAYESIAN ANALYSIS

3.1 Why HB estimation?

HB analysis introduces an extra level of sophistication to the analysis of discrete choice experiments. Unlike the logistic regression models reported in the previous section, this approach recognises that the choices are clustered by individual respondents.

HB analysis has the ability to provide estimates of individual part-worth utilities given only a few choices by each individual respondent. It does this by ‘borrowing’ information from population information (means and covariances) describing the preferences of other respondents in the same dataset[14]. This is particularly useful when the focus of the research is to understand the differences between respondent sub-groups, as in this study. The Sawtooth CBC/HB package was used for this analysis (CBC = choice-based conjoint).

The ‘hierarchy’ in this modelling approach is composed of two steps:

- At the ‘higher’ level, individuals' part-worths are described by a multivariate normal distribution and characterised by a vector of means and a matrix of covariances[15]
- At the ‘lower’ level it is assumed that, given an individual's part worth utilities, their probabilities of choosing particular alternatives take the form of an MNL model.

Through an iterative process, a set of mean part-worth estimates and standard deviations are estimated for each individual respondent.

In this analysis the functional forms of the models were the same as described for the logistic regression models. The values of most interest are WTA for unplanned outages, domestic and SME, as these correspond to the results that were used in the LE study to determine the overall VoLL.

14 Sawtooth, 2016, Software for Hierarchical Bayes Estimation for CBC Data v5
15 A prior variance of 1 with 5 prior degrees of freedom. Advice from Sawtooth is that “With many choice tasks per individual and few parameters to estimate, as in this study, the priors have relatively little effect on the posterior estimates of beta.”

3.2 Domestic willingness to accept compensation for unplanned outages

Figure 3.1 shows the model outputs for all domestic customers. This produced a similar VoLL to the logistic regression analysis for the total sample. In calculating the mean coefficient values, outliers at the 2.5% lower and upper percentiles were excluded.

When the analysis was undertaken for sub-groups, the average domestic usage figure of 0.00045 taken from the LE study was modified to reflect the average consumption of each group relative to the total sample[16]. This varied over a range of approximately 0.9 – 1.1.

Figure 3.1: CBC/HB results – Domestic unplanned – willingness to accept

Sample size	N=3,381	
	B	SE
Ln(duration) (1,20,120,240,960)	-0.3293	0.0076
Ln(duration) * freq2_3 (2-3 times in 3 years)	-0.0726	0.0070
Ln(duration) * freq4_6 (4-6 times in 3 years)	-0.1106	0.0069
Ln(duration) * freq7-14 (7 to 14 times in 3 years)	-0.3341	0.0083
Ln(duration) * freq15+ (15 or more times in 3 years)	-0.3726	0.0087
Price (compensation)	0.1253	0.0037
Don’t know	-7.3113	0.0840
RLH[17]	0.73	
Percent correct (%)	68	

WTP estimate for a one-hour outage:	£7.87 (-0.3293 * Ln(20)/0.1253)
Standard error of WTA:	£0.29
VoLL equivalent for 1 MWh:	**£17,481** (£7.87/0.00045, where 0.00045 is average domestic usage per hour)
Confidence interval (95%):	£16,209 – £18,753[18]
VoLL from logistic regression:	£16,257 (£14,838 – £17,677)

16 MPAN numbers that could be associated with individual respondents were used to obtain the average consumption

17 RLH is the geometric mean of the predicted probabilities: with three alternatives in this CE, the random value of RLH is 0.33 (1/3 choices); a value of 0.73 therefore indicates that the model is more than twice as strong as a purely random result. In a similar way, "Percent Certainty" indicates how much better the solution is than chance, as compared to a "perfect" solution.

18 This is based on the frequentist notion of the 95% confidence interval. As noted by Orme, 2016, ‘Confidence intervals for interpreting HB estimations’, Sawtooth Software Forum, this is “not truly appropriate for Bayesian estimates. But, we're already departing from proper Bayesian by collapsing the ‘used’ draws per respondent into a single point estimate per part-worth utility”. The range reported here is based on:

- The mean of the standard deviations calculated for each variable for each respondent, divided through by the square root of the sample size, to give an approximate standard error.
- The ‘delta method’ applied to calculate an approximate confidence interval for the WTA estimate

Figures 3.2 and 3.3 summarise the VoLL for a range of sub-groups, rank ordered by their value relative to the total sample domestic VoLL.

- The groups that require most compensation are those who want to improve supply, who are in fuel poverty, live in rural areas, are off-gas, have an electric vehicle or electric heat pump or are aged 30 – 44 years, in socio-economic group C1/C2.
- Counter-intuitively, with regard to power cuts, those that have no or moderate experience of power cuts require higher than average compensation, while those that require least compensation have experience of a large scale interruption in the last 12 months, have experienced a planned power cut, are classified as worst served.
- Similarly low values were identified among customers who are medically dependent on electricity and those in lower social groups DE.

Figure 3.2: VoLL values higher than total sample – domestic unplanned – willingness to accept

For a one-hour outage once every three years

Sub-group	n	WTA	VoLL (MWh)	Lower	Upper	Index v total sample
Want to improve supply	431	£11.28	**£25,334**	*£19,240*	*£31,429*	145
Fuel poverty	239	£9.43	**£21,646**	*£18,837*	*£24,456*	124
Domestic – EV	275	£9.20	**£21,493**	*£1,264*	*£41,722*	123
Rural	1023	£9.63	**£21,314**	*£18,361*	*£24,268*	122
SEG: C1	1040	£9.05	**£20,053**	*£17,667*	*£22,439*	115
Age: 30 – 44	770	£8.95	**£20,042**	*£17,017*	*£23,066*	115
Domestic – HP	428	£8.98	**£19,911**	*£5,578*	*£34,243*	114
Experienced one unplanned power cut	723	£8.85	**£19,755**	*£16,646*	*£22,865*	113
Experienced no power cuts	1178	£8.63	**£19,221**	*£16,534*	*£21,908*	110
SEG: C2	569	£8.54	**£19,217**	*£15,634*	*£22,801*	110
LCT users	960	£8.69	**£18,973**	*£11,743*	*£26,203*	109
Experienced two or three unplanned power cuts	847	£8.65	**£18,780**	*£15,957*	*£21,603*	107
Off-gas	721	£7.13	**£18,543**	*£14,598*	*£22,489*	106
Summer	1690	£8.39	**£18,496**	*£16,505*	*£20,487*	106
Female	1791	£8.26	**£18,432**	*£16,373*	*£20,490*	105
Domestic – PV	538	£8.42	**£17,884**	*£7,580*	*£28,189*	102
SEG: AB	835	£8.13	**£17,867**	*£15,241*	*£20,493*	102

Figure 3.3: VoLL values lower than total sample – domestic unplanned – willingness to accept

For a one-hour outage once every three years

Sub-group	n	WTA	VoLL (MWh)	Lower	Upper	Index v total sample
Age: 60+	994	£7.80	**£17,237**	*£14,719*	*£19,755*	99
Vulnerable	1951	£7.60	**£16,941**	*£15,005*	*£18,876*	97
Age: 45-59	844	£7.59	**£16,921**	*£14,973*	*£18,869*	97
Male	1510	£7.62	**£16,891**	*£15,272*	*£18,510*	97
Experienced power cuts	2203	£7.57	**£16,802**	*£15,376*	*£18,228*	96
Age: 18-29	702	£7.50	**£16,516**	*£13,252*	*£19,779*	94
High usage	328	£7.60	**£16,504**	*£12,952*	*£20,056*	94
Winter	1620	£7.39	**£16,464**	*£14,828*	*£18,101*	94
Low usage	1216	£7.26	**£16,371**	*£14,510*	*£18,231*	94
Experienced planned power cut	859	£7.30	**£16,161**	*£13,395*	*£18,928*	92
Urban	2353	£7.16	**£15,934**	*£14,572*	*£17,295*	91
Want to keep bills constant	1265	£7.19	**£15,863**	*£14,024*	*£17,702*	91
SEG: DE	843	£6.15	**£13,667**	*£11,479*	*£15,855*	78
Medically dependent on electricity	310	£5.97	**£13,487**	*£9,517*	*£17,457*	77
Experienced large scale interruption L12M	377	£5.82	**£12,140**	*£7,660*	*£16,619*	69
Worst served	163	£3.16	**£6,894**	*£2,345*	*£11,442*	39

Grey font indicates small sample size, interpret with caution

Customers' willingness to accept compensation for outages will reflect their own economic circumstances to some extent. To adjust for this, the VoLL for each group can be modified to indicate the likely value if the average income of that group was the same as for the total population. The adjustment was:

$$VoLL_{\text{sub-group, income adjusted}} = VoLL * \text{average income}_{\text{total sample}} / \text{average income}_{\text{sub-group}}$$

The effect of this adjustment is shown in Figure 3.4. These results suggest that the change in VoLL can be substantial, notably for fuel poor, lower socio-economic groups, vulnerable and those with low electricity usage.

Figure 3.4: Income-adjusted VoLL values – domestic unplanned – willingness to accept

Sub-group	VoLL	*VoLL (Income adjusted)*	Ratio v Unadjusted VoLL
Want to improve supply	£25,334	***£23,633***	*93*
Fuel poverty	£21,646	***£32,470***	*150*
Domestic – EV	£21,493	***£15,589***	*73*
Rural	£21,314	***£21,652***	*102*
SEG: C1	£20,053	***£20,621***	*103*
Age: 30 – 44	£20,042	***£17,905***	*89*
Domestic – HP	£19,911	***£18,785***	*94*
Experienced one unplanned power cut	£19,755	***£19,646***	*99*
Experienced no power cuts	£19,221	***£20,444***	*106*
SEG: C2	£19,217	***£21,091***	*110*
LCT users	£18,973	***£17,494***	*92*
Experienced two or three unplanned power cuts	£18,780	***£17,960***	*96*
Off-gas	£18,543	***£21,461***	*116*
Summer	£18,496	***£18,723***	*101*
Female	£18,432	***£19,799***	*107*
Domestic – PV	£17,884	***£17,140***	*96*
SEG: AB	£17,867	***£11,901***	*67*
Want to keep reliability	£17,745	***£18,654***	*105*
Age: 60+	£17,237	***£19,372***	*112*

Sub-group	VoLL	***VoLL (Income adjusted)***	Ratio v Unadjusted VoLL
Vulnerable	£16,941	***£19,632***	*116*
Age: 45-59	£16,921	***£16,379***	*97*
Male	£16,891	***£15,817***	*94*
Experienced power cuts	£16,802	***£16,296***	*97*
Age: 18-29	£16,516	***£17,490***	*106*
High usage	£16,504	***£14,288***	*87*
Winter	£16,464	***£16,302***	*99*
Low usage	£16,371	***£19,665***	*120*
Experienced planned power cut	£16,161	***£15,668***	*97*
Urban	£15,934	***£15,817***	*99*
Want to keep bills constant	£15,863	***£16,344***	*103*
SEG: DE	£13,667	***£20,501***	*150*
Medically dependent on electricity	£13,487	***£18,013***	*134*
Experienced large scale interruption L12M	£12,140	***£11,768***	*97*
Worst served	£6,894	***£7,595***	*110*
Want to improve supply	£25,334	***£23,633***	*93*

3.3 SME willingness to accept compensation for unplanned outages

Figure 3.5 shows the model outputs for all SME customers. This produced a slightly higher VoLL compared to the logistic regression analysis for the total sample. In calculating the mean coefficient values, outliers at the 2.5% lower and upper percentiles were excluded.

Figure 3.5: CBC/HB results – SME unplanned – willingness to accept

Sample size	N=615	
	B	SE
Ln(duration) (1,20,120,240,960)	-0.3737	0.0395
Ln(duration) * freq2_3 (2-3 times in 3 years)	0.0631	0.0487[19]
Ln(duration) * freq4_6 (4-6 times in 3 years)	-0.2658	0.0501
Ln(duration) * freq7-14 (7 to 14 times in 3 years)	-0.3097	0.0515
Ln(duration) * freq15+ (15 or more times in 3 years)	-0.4838	0.0490
Price (compensation)	0.1207	0.0178
Don't know	-5.2185	0.2888
RLH		0.70
Percent correct (%)		63

WTA estimate for a one-hour outage:	£226.70 (-0.3737 * Ln(20)/0.1207)* £2,500/100
Standard error of WTP:	£1.30
VoLL equivalent for 1 MWh:	**£47,560** (£226.70 /0.00336, where 0.00336 is average SME usage per hour)
Confidence interval (95%):	£45,289 - £49,830
VoLL from logistic regression:	£43,787 (£30,997 – £56,576)

In the same way as for domestic sub-groups, the average SME usage figure of 0.00336, taken from the LE study, was modified to reflect the average consumption of each group relative to the total sample[20]. This varied over a range of approximately 0.8 – 1.2.

Figures 3.6 and 3.7 summarises the VoLL for a range of sub-groups, rank ordered by their value relative to the total sample SME VoLL.

- The groups that require most compensation are those who were surveyed in the summer, are located in rural areas, have some experience of unplanned power cuts or are off-gas
- Those requiring less compensation were those surveyed in winter, have not experienced unplanned power cuts or have experienced planned power cuts
- In contrast to domestic customers, those that say they want to improve supply or maintain reliability require less compensation. The comparatively small sample sizes for these groups suggests that these findings should be treated with caution.

19 Not significantly different from zero
20 MPAN numbers that could be associated with individual respondents were used to obtain the average consumption

Figure 3.6: VoLL values higher than total sample – SME unplanned – willingness to accept

For a one-hour outage once every three years

Sub-group	n	WTA	VoLL (MWh)	Lower	Upper	Index v total sample
Summer	287	£228.64	**£77,843**	*£73,572*	*£82,115*	164
Rural	118	£216.91	**£68,452**	*£58,201*	*£78,703*	144
Experienced power cuts	376	£153.25	**£51,341**	*£47,981*	*£54,701*	108
Off-gas	316	£152.44	**£49,056**	*£46,406*	*£51,706*	103

Grey font indicates small sample size, interpret with caution

Figure 3.7: VoLL values lower than total sample – SME unplanned – willingness to accept

For a one-hour outage once every three years

Sub-group	n	WTA	VoLL (MWh)	Lower	Upper	Index v total sample
Want to keep bills constant	188	£143.51	**£45,823**	*£42,297*	*£49,349*	96
Urban	489	£152.05	**£43,885**	*£41,680*	*£46,090*	92
Experienced planned power cut	185	£123.86	**£43,714**	*£39,058*	*£48,371*	92
Want to keep reliability	141	£124.13	**£38,564**	*£33,832*	*£43,296*	81
Experience no power cuts	239	£147.00	**£38,167**	*£35,648*	*£40,686*	80
Want to improve supply	161	£130.71	**£32,919**	*£30,044*	*£35,793*	69
Winter	319	£73.31	**£19,099**	*£17,079*	*£21,119*	40

Grey font indicates small sample size, interpret with caution

3.4 Observations on the results by season

The large difference in the SME VoLL observed for those completing the survey in summer compared to winter would appear counter-intuitive, as it might be anticipated that customers would be more sensitive to the impact of outages when considering them during winter than in the summer.

If the difference had been relatively small, as is seen for domestic customers, it could be explained by the fact that respondents were asked to make their choices in the context of the worst possible time. Therefore choices should reflect this context regardless of whether the surveys were undertaken in summer or winter.

The large difference for SMEs suggests some other explanation, which may be due to the relatively small sample sizes. It implies differences across the samples for each season that are not readily explainable from the respondent profiles or compensated for by the weighting of the data.

ANNEX 1.1: PILOT SURVEY

Background

Although Hierarchical Bayesian analysis was used as the main approach to derive the utilities for estimation of WTP and WTA, a logistic regression approach was also used to try to replicate results comparable to those from the LE models.

Sufficient data was available to make meaningful comparisons for domestic customers (samples at the pilot stage for SME, totalling 104, were regarded as too small for a meaningful comparison with the LE study). A pilot sample of 826 domestic customers was obtained through a mixture of online self-completion and face-to-face interviewer-administered surveys. Each respondent completed a discrete choice exercise similar in form to the LE study.

The data was arranged in the same way as the LE study, including a 'don't know option' and rescaling all variables to a 'dummy' (0 and 1) code or as a metric scale (duration and price). It should be noted that there were key differences in the design so models could not be run identically to LE.

Key differences in design

	London Economics	Impact
Duration	Covered 20 minutes, one hour, four hours	Three minutes, one hour, four hours, 12 hours, 12-24 hours, 2-3 days
Winter	Included a winter variable	Pilot survey was not conducted in winter
Planned	Not included	Included
Peak time	Peak time considered 3-9pm	Peak domestic – 3-9pm Peak SME – 9-3pm
Advanced warning	Not included	Included
Price	£1, £5, £10, £15 1%, 5%, 10%, 15%	£1, £3, £5, £7, £12, £15 1%, 3%, 5%, 7%, 12%, 15%
Frequency	Did not include frequency of outage due to perceived complication	Outages per three years: 1, 2-3, 4-6, 7-14, 15+

The model was specified as:

$$Pi = a + b1.duration + b2.dur_{freq} + b3.dur_{wday} + b4.bill + don't\ know$$

Where: Pi = probability of choosing option i
$b1$= duration of outage in minutes
$b2$= duration x frequency of outage in three years
$b3$= duration x weekday/weekend (1,0)
$b4$= bill change

WTP and WTA values were calculated by taking the ratio of (b1+b2+b3) to b4.

Comparisons – domestic

Willingness to pay

Despite some of the key differences listed above, the WTP estimations for domestic users, derived from this study using models as similar as possible to the LE model, produced much lower estimates for weekend MWh values and higher (> 0) for weekday values. A winter variable was not included, but in these pilot exercises respondents were asked to consider the most inconvenient time for an outage to occur, so the comparison is made against 'winter', identified in the LE study as the worst time of year.

The resulting WTP values are shown below, together with the corresponding LE results:

Duration	Winter Peak Weekend		Winter Not peak Weekend		Winter Peak Weekday		Winter Not Peak Weekday	
	LE	**Impact**	**LE**	**Impact**	**LE**	**Impact**	**LE**	**Impact**
20 mins	£0.32	£0.07	£0.32	£0.11	£0.04	£0.07	£0.05	£0.12
1 hour	£0.96	£0.22	£0.97	£0.34	£0.12	£0.22	£0.14	£0.35
4 hours	£3.82	£0.28	£3.89	£1.37	£0.50	£0.89	£0.57	£1.28
1 MWh	£1,651	£490	£2,240	£762	*£208*	£495	*£315*	£768

*Based on 0.00045MWh consumption

Model outputs

	B	S.E.	Wald	df	Sig.	Exp(B)
Duration	-.055	.007	65.787	1	.000	.946
Duration x frequency	.020	.008	5.476	1	.019	1.020
Duration x weekday	.000	.007	.003	1	.956	1.000
Bill	-.161	.005	887.747	1	.000	.852
Don't know	-2.844	.070	1648.489	1	0.000	.058
Constant	1.041	.053	379.618	1	.000	2.833

Willingness to accept

Given some of the key differences listed above, the estimations of WTA values for domestic users are reasonably close to the LE results.

Duration	Winter Peak Weekend		Winter Not peak Weekend		Winter Peak Weekday		Winter Not Peak Weekday	
	LE	**Impact**	**LE**	**Impact**	**LE**	**Impact**	**LE**	**Impact**
20 mins	£2.28	£1.79	£1.59	£1.20	£2.05	£1.67	£1.36	£1.08
1 hour	£6.84	£5.37	£4.77	£3.60	£6.16	£5.01	£4.09	£3.24
4 hours	£127.37	£21.49	£19.07	£14.40	£24.64	£20.06	£16.35	£12.97
1 MWh	£11,820	£11,930	£10,982	£7,994	£10,289	£11,136	£9,100	£7,200

*Based on 0.0005MWh consumption

	B	S.E.	Wald	df	Sig.	Exp(B)
Duration	-.092	.006	239.813	1	.000	.912
Duration x frequency	-.045	.009	24.932	1	.000	.956
Duration x weekday	.009	.007	1.549	1	.213	1.009
Bill	.026	.005	29.149	1	.000	1.026
Don’t know	-2.754	.079	1215.925	1	.000	.064
Constant	.223	.051	19.206	1	.000	1.250

ANNEX 1.2: STATISTICAL DESIGNS (MAIN SURVEY)

Generating the designs

The Sawtooth Survey Sampling International (SSI) web design package was used to generate the statistical design. As indicated in the SSI manual: “Optimally efficient CBC designs can estimate all part-worths with optimal precision; meaning that the standard errors of the estimates are as small as possible, given the total observations (respondents x tasks), the number of product concepts displayed per task, and respondent preferences. CBC's random design strategies generally result in very efficient designs. These designs are not *optimally* efficient, but are nearly so.”[21]

The lack of any prohibitions (ie disallowed combinations of attribute levels) in the designs and the large sample size planned for the study indicated that an efficient design should be achievable for the number of attributes and levels being tested. The only constraint was the restricted number of versions (27 blocks of six for domestic customers, nine blocks of six for SMEs).

Design profile statistics

Domestic unplanned

Figures 1.2.1a to 1.2.4b below summarises the profile statistics for the domestic unplanned design.

As described in the SSI manual, an approximation is made of the relative standard error of each main effect under aggregate analysis and assuming that each version is seen just once across the total observations. Ordinary least squares (OLS) is used for this purpose. This test design method gives relative standard error estimates similar to (but not identical to) those of MNL. With this test, the emphasis is not on a precise estimate of each standard error for a given number of respondents, but rather the pattern of their relative magnitudes with respect to one another. These are reported for each design in the ‘a’ figures below.

The ‘advanced test’ design estimates the absolute precision of the parameter estimates under aggregate estimation, based on the combined elements of design efficiency and sample size (respondents x tasks). The test is useful for both standard and complex designs that include interactions or alternative-specific effects. It also reports a widely accepted measure of design efficiency called D-efficiency, which summarises the overall relative precision of the design.

The advanced test simulates random (dummy) respondent answers. The test is run with respect to a given model specification (main effects only in this case). To perform the advanced test, a total sample similar to those anticipated for the main survey was used, eg 3,000 domestic customers (ie approximately the number that would see the unplanned exercise). It was also assumed that 5% would choose ‘not sure’. Although it is possible to assume prior values for the coefficients (for example, willingness-to-pay ratios for duration v price attributes), it is more common not to assume any prior values. Using random respondent answers in this way is considered a robust approach, because it estimates the efficiency of the design for respondents with heterogeneous and unknown preferences. Once the data set has been simulated, the advanced test performs an aggregate logit (MNL) run.

---

21 SSI Web Documentation, 2011, Software for Web Interviewing and Conjoint Analysis, p347, Sawtooth Inc.

Figure 1.2.1a: Domestic unplanned design statistics

```
Task generation method is 'Complete Enumeration' using a seed of 1.
Based on 27 version(s).
Includes 162 total choice tasks (6 per version).
Each choice task includes 2 concepts and 3 attributes.


A Priori Estimates of Standard Errors for Attribute Levels
-------------------------------------------------------------
Att/Lev   Freq.   Actual    Ideal      Effic.
 1    1        65 (this level has been deleted) 1
 1    2        64   0.2236   0.2222   0.9875    2
 1    3        65   0.2232   0.2222   0.9917    3
 1    4        65   0.2249   0.2222   0.9762    4
 1    5        65   0.2229   0.2222   0.9940    5

 2    1        64 (this level has been deleted) 1
 2    2        65   0.2230   0.2222   0.9928    2
 2    3        65   0.2261   0.2222   0.9660    3
 2    4        65   0.2195   0.2222   1.0247    4
 2    5        65   0.2349   0.2222   0.8947    5

 3    1        65 (this level has been deleted) 1
 3    2        65   0.2217   0.2222   1.0048    2
 3    3        64   0.2285   0.2222   0.9459    3
 3    4        65   0.2270   0.2222   0.9582    4
 3    5        65   0.2201   0.2222   1.0193    5
```

The column labelled 'actual' gives estimated standard errors for the data file analysed and the column labelled 'ideal' gives an estimate of what those standard errors would be if the design were precisely orthogonal and had the same number of observations.

The column labelled 'effic' gives the relative efficiency of this design in terms of estimating each parameter, compared to the hypothetical orthogonal design (it is the square of their ratio).

All the results here lie within the range 0.9 to 1.1, suggesting a good level of efficiency. The table of two-way frequencies also illustrates a well balanced design.

Two-Way Frequencies

Att/Lev	1/1	1/2	1/3	1/4	1/5	2/1	2/2	2/3	2/4	2/5	3/1	3/2	3/3	3/4	3/5
1/1	65	0	0	0	0	13	13	13	13	13	13	13	13	13	13
1/2	0	64	0	0	0	12	13	13	13	13	13	14	12	12	13
1/3	0	0	65	0	0	13	13	13	13	13	13	13	13	13	13
1/4	0	0	0	65	0	13	13	13	13	13	13	13	13	13	13
1/5	0	0	0	0	65	13	13	13	13	13	13	12	13	14	13
2/1	13	12	13	13	13	64	0	0	0	0	13	13	13	13	12
2/2	13	13	13	13	13	0	65	0	0	0	13	13	13	13	13
2/3	13	13	13	13	13	0	0	65	0	0	13	12	12	14	14
2/4	13	13	13	13	13	0	0	0	65	0	13	14	13	12	13
2/5	13	13	13	13	13	0	0	0	0	65	13	13	13	13	13
3/1	13	13	13	13	13	13	13	13	13	13	65	0	0	0	0
3/2	13	14	13	13	12	13	13	12	14	13	0	65	0	0	0
3/3	13	12	13	13	13	13	13	12	13	13	0	0	64	0	0
3/4	13	12	13	13	14	13	13	14	12	13	0	0	0	65	0
3/5	13	13	13	13	13	12	13	14	13	13	0	0	0	0	65

Figure 1.2.1b: Domestic unplanned advanced design statistics

```
Logit Report with Simulated Data
-------------------------------------------------------------
Main Effects: 1 2 3
Build includes 3000 respondents.

Total number of choices in each response category:
Category   Number  Percent
-----------------------------------------------------
       1    8574   47.63%
       2    8532   47.40%
       3     894    4.97%

There are 18000 expanded tasks in total, or an average of 6.0 tasks per respondent.


Iter    1  Log-likelihood = -16364.30783  Chi Sq = 6821.42674  RLH = 0.40288
Iter    2  Log-likelihood = -15591.18915  Chi Sq = 8367.66410  RLH = 0.42056
Iter    3  Log-likelihood = -15429.98600  Chi Sq = 8690.07039  RLH = 0.42434
Iter    4  Log-likelihood = -15408.72690  Chi Sq = 8732.58858  RLH = 0.42484
Iter    5  Log-likelihood = -15407.16479  Chi Sq = 8735.71282  RLH = 0.42488
Iter    6  Log-likelihood = -15407.08859  Chi Sq = 8735.86521  RLH = 0.42488
Iter    7  Log-likelihood = -15407.08540  Chi Sq = 8735.87159  RLH = 0.42488
Iter    8  Log-likelihood = -15407.08527  Chi Sq = 8735.87185  RLH = 0.42488
Iter    9  Log-likelihood = -15407.08526  Chi Sq = 8735.87186  RLH = 0.42488
*Converged

         Effect        Std Err        t Ratio     Attribute Level
   1      0.00292       0.01912        0.15291    1 1 1
   2      0.02449       0.01944        1.25953    1 2 2
   3     -0.03079       0.01914       -1.60874    1 3 3
   4     -0.00553       0.01919       -0.28819    1 4 4
   5      0.00890       0.01920        0.46364    1 5 5

   6      0.01919       0.01942        0.98803    2 1 1
   7     -0.01082       0.01923       -0.56277    2 2 2
   8     -0.03375       0.01926       -1.75294    2 3 3
   9      0.01192       0.01913        0.62337    2 4 4
  10      0.01346       0.01929        0.69803    2 5 5

  11     -0.00833       0.01922       -0.43355    3 1 1
  12      0.02386       0.01914        1.24631    3 2 2
  13     -0.02306       0.01937       -1.19023    3 3 3
  14      0.00782       0.01921        0.40687    3 4 4
  15     -0.00028       0.01918       -0.01478    3 5 5

  16     -2.25821       0.03431      -65.82431    NONE

The strength of design for this model is 3262.28901
```

The data in the Effect (utilities) and T-ratio columns are not relevant, as the test is using random data. The important column is the Aggregate Std Err (standard error) column. The standard errors reflect the precision obtained for each parameter. Lower error means greater precision.

This design included no prohibitions, so the standard errors are quite uniform within each attribute. The levels within four-level attributes all have standard errors around 0.019.

Suggested guidelines are:

- Standard errors within each attribute should be roughly equivalent
- Standard errors for main effects should be no larger than about 0.05
- Standard errors for interaction effects should be no larger than about 0.10.

The second two criteria are Sawtooth's 'rules of thumb' based on experience with many different data sets and recommendations regarding minimum sample sizes and minimum acceptable precision[22]. The standard errors here are within the recommended value for main effects.

Figure 1.2.2a: SME unplanned design statistics

```
Task generation method is 'Complete Enumeration' using a seed of 1.
Based on 9 version(s).
Includes 54 total choice tasks (6 per version).
Each choice task includes 2 concepts and 3 attributes.


A Priori Estimates of Standard Errors for Attribute Levels
-------------------------------------------------------------
Att/Lev    Freq.   Actual    Ideal      Effic.
 1    1        22 (this level has been deleted) 1
 1    2        22   0.3952   0.3849   0.9486    2
 1    3        21   0.4023   0.3849   0.9155    3
 1    4        21   0.4019   0.3849   0.9173    4
 1    5        22   0.3932   0.3849   0.9581    5

 2    1        22 (this level has been deleted) 1
 2    2        21   0.4149   0.3849   0.8605    2
 2    3        22   0.4042   0.3849   0.9068    3
 2    4        21   0.3705   0.3849   1.0790    4
 2    5        22   0.4401   0.3849   0.7648    5

 3    1        22 (this level has been deleted) 1
 3    2        21   0.3883   0.3849   0.9827    2
 3    3        21   0.4094   0.3849   0.8838    3
 3    4        22   0.4032   0.3849   0.9114    4
 3    5        22   0.3846   0.3849   1.0015    5
```

The column labelled 'effic' gives the relative efficiency of this design in terms of estimating each parameter, compared to the hypothetical orthogonal design (it is the square of their ratio).

All the results here lie within the range 0.7 to 1.1, suggesting a reasonable level of efficiency for most attributes but relatively lower efficiency for the top level of the second attribute (frequency of outage). The table of two-way frequencies also illustrates a well balanced design.

Two-Way Frequencies

Att/Lev	1/1	1/2	1/3	1/4	1/5	2/1	2/2	2/3	2/4	2/5	3/1	3/2	3/3	3/4	3/5
1/1	22	0	0	0	0	4	4	4	5	5	5	4	5	4	4
1/2	0	22	0	0	0	4	5	5	4	4	4	5	4	4	5
1/3	0	0	21	0	0	4	4	5	4	4	4	4	4	5	4
1/4	0	0	0	21	0	5	4	4	4	4	4	4	4	4	5
1/5	0	0	0	0	22	5	4	4	4	5	5	4	4	5	4
2/1	4	4	4	5	5	22	0	0	0	0	4	5	4	4	5
2/2	4	5	4	4	4	0	21	0	0	0	4	4	4	5	4
2/3	4	5	5	4	4	0	0	22	0	0	5	4	4	5	4
2/4	5	4	4	4	4	0	0	0	21	0	4	4	4	4	5
2/5	5	4	4	4	5	0	0	0	0	22	5	4	5	4	4
3/1	5	4	4	4	5	4	4	5	4	5	22	0	0	0	0
3/2	4	5	4	4	4	5	4	4	4	4	0	21	0	0	0

22 Sawtooth SSI Web, p352

Figure 1.2.2b: SME unplanned advanced design statistics

```
Logit Report with Simulated Data
------------------------------------------------------------
Main Effects: 1 2 3
Build includes 1000 respondents.

Total number of choices in each response category:
Category   Number  Percent
-----------------------------------------------------
       1    2766   46.10%
       2    2921   48.68%
       3     313    5.22%

There are 6000 expanded tasks in total, or an average of 6.0 tasks per respondent.


Iter    1  Log-likelihood = -5469.32429  Chi Sq = 2244.69888  RLH = 0.40190
Iter    2  Log-likelihood = -5220.48972  Chi Sq = 2742.36802  RLH = 0.41892
Iter    3  Log-likelihood = -5170.13347  Chi Sq = 2843.08051  RLH = 0.42245
Iter    4  Log-likelihood = -5163.76704  Chi Sq = 2855.81338  RLH = 0.42290
Iter    5  Log-likelihood = -5163.31679  Chi Sq = 2856.71389  RLH = 0.42293
Iter    6  Log-likelihood = -5163.29522  Chi Sq = 2856.75703  RLH = 0.42293
Iter    7  Log-likelihood = -5163.29432  Chi Sq = 2856.75883  RLH = 0.42293
Iter    8  Log-likelihood = -5163.29428  Chi Sq = 2856.75890  RLH = 0.42293
Iter    9  Log-likelihood = -5163.29428  Chi Sq = 2856.75891  RLH = 0.42293
*Converged


         Effect        Std Err       t Ratio      Attribute Level
  1      0.03420       0.03330       1.02699     1 1 1
  2     -0.04084       0.03439      -1.18758     1 2 2
  3      0.05746       0.03487       1.64784     1 3 3
  4     -0.03315       0.03586      -0.92432     1 4 4
  5     -0.01767       0.03480      -0.50759     1 5 5

  6     -0.02197       0.03440      -0.63878     2 1 1
  7      0.02579       0.03558       0.72476     2 2 2
  8      0.03871       0.03404       1.13728     2 3 3
  9     -0.03445       0.03583      -0.96144     2 4 4
 10     -0.00808       0.03503      -0.23070     2 5 5

 11      0.03346       0.03392       0.98654     3 1 1
 12     -0.07741       0.03391      -2.28276     3 2 2
 13      0.02372       0.03449       0.68779     3 3 3
 14     -0.01751       0.03349      -0.52278     3 4 4
 15      0.03773       0.03313       1.13876     3 5 5

 16     -2.20554       0.05806     -37.98400     NONE

The strength of design for this model is 1053.34857
```

The standard errors here are within the recommended value for main effects (0.05).

Figure 1.2.3a: Domestic planned design statistics

```
Task generation method is 'Complete Enumeration' using a seed of 1.
Based on 27 version(s).
Includes 162 total choice tasks (6 per version).
Each choice task includes 2 concepts and 4 attributes.


A Priori Estimates of Standard Errors for Attribute Levels
-------------------------------------------------------------
Att/Lev   Freq.   Actual    Ideal      Effic.
 1    1       81 (this level has been deleted) 1
 1    2       81   0.1893   0.1925   1.0336    2
 1    3       81   0.1987   0.1925   0.9380    3
 1    4       81   0.1954   0.1925   0.9699    4

 2    1       81 (this level has been deleted) 1
 2    2       81   0.1892   0.1925   1.0342    2
 2    3       81   0.2009   0.1925   0.9181    3
 2    4       81   0.1954   0.1925   0.9695    4

 3    1      108 (this level has been deleted) 1
 3    2      108   0.1585   0.1571   0.9826    2
 3    3      108   0.1591   0.1571   0.9750    3

 4    1       65 (this level has been deleted) 1
 4    2       64   0.2325   0.2222   0.9132    2
 4    3       65   0.2255   0.2222   0.9709    3
 4    4       65   0.2179   0.2222   1.0401    4
 4    5       65   0.2239   0.2222   0.9850    5
```

The column labelled 'effic' gives the relative efficiency of this design in terms of estimating each parameter, compared to the hypothetical orthogonal design (it is the square of their ratio).

All the results here lie within the range 0.9 to 1.1, suggesting a good level of efficiency. The table of two-way frequencies also illustrates a well-balanced design.

Two-Way Frequencies

Att/Lev	1/1	1/2	1/3	1/4	2/1	2/2	2/3	2/4	3/1	3/2	3/3	4/1	4/2	4/3	4/4	4/5
1/1	81	0	0	0	20	20	21	20	26	28	27	17	15	17	16	16
1/2	0	81	0	0	20	21	20	20	28	26	27	16	17	16	16	16
1/3	0	0	81	0	21	20	20	20	27	27	27	16	16	16	17	16
1/4	0	0	0	81	20	20	20	21	27	27	27	16	16	16	16	17
2/1	20	20	21	20	81	0	0	0	27	28	26	16	16	16	17	16
2/2	20	21	20	20	0	81	0	0	28	26	27	16	16	16	16	17
2/3	21	20	20	20	0	0	81	0	26	27	28	17	16	17	16	15
2/4	20	20	20	21	0	0	0	81	27	27	27	16	16	16	16	17
3/1	26	28	27	27	27	28	26	27	108	0	0	22	22	21	21	22
3/2	28	26	27	27	28	26	27	27	0	108	0	22	21	22	22	21

Figure 1.2.3b: Domestic planned advanced design statistics

```
Logit Report with Simulated Data
------------------------------------------------------------
Main Effects: 1 2 3 4
Build includes 1500 respondents.

Total number of choices in each response category:
Category   Number  Percent
-----------------------------------------------------
       1    4276   47.51%
       2    4278   47.53%
       3     446    4.96%

There are 9000 expanded tasks in total, or an average of 6.0 tasks per respondent.


Iter    1  Log-likelihood = -8173.57313  Chi Sq = 3427.87494  RLH = 0.40326
Iter    2  Log-likelihood = -7786.71658  Chi Sq = 4201.58803  RLH = 0.42097
Iter    3  Log-likelihood = -7705.97162  Chi Sq = 4363.07796  RLH = 0.42477
Iter    4  Log-likelihood = -7695.30753  Chi Sq = 4384.40614  RLH = 0.42527
Iter    5  Log-likelihood = -7694.52287  Chi Sq = 4385.97546  RLH = 0.42531
Iter    6  Log-likelihood = -7694.48457  Chi Sq = 4386.05206  RLH = 0.42531
Iter    7  Log-likelihood = -7694.48296  Chi Sq = 4386.05527  RLH = 0.42531
Iter    8  Log-likelihood = -7694.48290  Chi Sq = 4386.05540  RLH = 0.42531
Iter    9  Log-likelihood = -7694.48290  Chi Sq = 4386.05540  RLH = 0.42531
*Converged


         Effect        Std Err        t Ratio      Attribute Level
  1      -0.00994       0.02291       -0.43414     1 1 1
  2      -0.04004       0.02279       -1.75672     1 2 2
  3       0.02937       0.02300        1.27681     1 3 3
  4       0.02062       0.02278        0.90501     1 4 4

  5       0.01363       0.02295        0.59393     2 1 1
  6      -0.00080       0.02312       -0.03471     2 2 2
  7      -0.02053       0.02291       -0.89609     2 3 3
  8       0.00770       0.02290        0.33636     2 4 4

  9      -0.03090       0.01771       -1.74471     3 1 1
 10       0.02179       0.01765        1.23475     3 2 2
 11       0.00912       0.01771        0.51485     3 3 3

 12      -0.03031       0.02731       -1.10990     4 1 1
 13       0.08625       0.02730        3.15949     4 2 2
 14      -0.00152       0.02721       -0.05596     4 3 3
 15      -0.02028       0.02712       -0.74793     4 4 4
 16      -0.03414       0.02728       -1.25156     4 5 5

 17      -2.26039       0.04857      -46.53916     NONE
```

The standard errors here are within the recommended value for main effects (0.05).

Figure 1.2.4a: SME planned design statistics

```
Task generation method is 'Complete Enumeration' using a seed of 1.
Based on 9 version(s).
Includes 54 total choice tasks (6 per version).
Each choice task includes 2 concepts and 4 attributes.


A Priori Estimates of Standard Errors for Attribute Levels
-------------------------------------------------------------
Att/Lev    Freq.   Actual    Ideal      Effic.
 1    1        27 (this level has been deleted) 1
 1    2        27   0.3316   0.3333   1.0106    2
 1    3        27   0.3589   0.3333   0.8626    3
 1    4        27   0.3576   0.3333   0.8687    4

 2    1        27 (this level has been deleted) 1
 2    2        27   0.3501   0.3333   0.9067    2
 2    3        27   0.3633   0.3333   0.8417    3
 2    4        27   0.3485   0.3333   0.9148    4

 3    1        36 (this level has been deleted) 1
 3    2        36   0.2783   0.2722   0.9567    2
 3    3        36   0.2780   0.2722   0.9582    3

 4    1        22 (this level has been deleted) 1
 4    2        22   0.4117   0.3849   0.8740    2
 4    3        21   0.3769   0.3849   1.0428    3
 4    4        21   0.3930   0.3849   0.9593    4
 4    5        22   0.4089   0.3849   0.8862    5
```

The column labelled 'effic' gives the relative efficiency of this design in terms of estimating each parameter, compared to the hypothetical orthogonal design (it is the square of their ratio).

All the results here lie within the range 0.8 to 1.1, suggesting a reasonable level of efficiency. The table of two-way frequencies also illustrates a well-balanced design.

Two-Way Frequencies

Att/Lev	1/1	1/2	1/3	1/4	2/1	2/2	2/3	2/4	3/1	3/2	3/3	4/1	4/2	4/3	4/4	4/5
1/1	27	0	0	0	6	7	7	7	9	9	9	6	6	5	5	5
1/2	0	27	0	0	7	6	7	7	9	9	9	4	5	6	6	6
1/3	0	0	27	0	7	7	7	6	9	9	9	6	5	5	5	6
1/4	0	0	0	27	7	7	6	7	9	9	9	6	6	5	5	5
2/1	6	7	7	7	27	0	0	0	8	9	10	5	6	6	5	5
2/2	7	6	7	7	0	27	0	0	9	9	9	5	6	5	5	6
2/3	7	7	7	6	0	0	27	0	9	9	9	6	5	5	6	5
2/4	7	7	6	7	0	0	0	27	10	9	8	6	5	5	5	6
3/1	9	9	9	9	8	9	9	10	36	0	0	7	7	7	7	8
3/2	9	9	9	9	9	9	9	9	0	36	0	7	8	7	7	7

Figure 1.2.4b: SME planned advanced design statistics

```
Logit Report with Simulated Data
-------------------------------------------------------------
Main Effects: 1 2 3 4
Build includes 500 respondents.

Total number of choices in each response category:
Category   Number  Percent
-----------------------------------------------------
       1    1493   49.77%
       2    1366   45.53%
       3     141    4.70%

There are 3000 expanded tasks in total, or an average of 6.0 tasks per respondent.


Iter    1  Log-likelihood = -2710.73397  Chi Sq = 1170.20578  RLH = 0.40512
Iter    2  Log-likelihood = -2577.38380  Chi Sq = 1436.90614  RLH = 0.42353
Iter    3  Log-likelihood = -2548.70316  Chi Sq = 1494.26740  RLH = 0.42760
Iter    4  Log-likelihood = -2544.74707  Chi Sq = 1502.17959  RLH = 0.42816
Iter    5  Log-likelihood = -2544.44378  Chi Sq = 1502.78616  RLH = 0.42821
Iter    6  Log-likelihood = -2544.42868  Chi Sq = 1502.81637  RLH = 0.42821
Iter    7  Log-likelihood = -2544.42804  Chi Sq = 1502.81765  RLH = 0.42821
Iter    8  Log-likelihood = -2544.42802  Chi Sq = 1502.81770  RLH = 0.42821
Iter    9  Log-likelihood = -2544.42802  Chi Sq = 1502.81770  RLH = 0.42821
*Converged


         Effect        Std Err        t Ratio      Attribute Level
  1      0.00425       0.04090        0.10387     1 1 1
  2     -0.05491       0.04151       -1.32264     1 2 2
  3      0.05818       0.04000        1.45457     1 3 3
  4     -0.00752       0.04124       -0.18247     1 4 4

  5     -0.03707       0.04189       -0.88513     2 1 1
  6      0.01817       0.04081        0.44521     2 2 2
  7      0.04861       0.04036        1.20460     2 3 3
  8     -0.02971       0.04005       -0.74192     2 4 4

  9      0.02283       0.03099        0.73678     3 1 1
 10      0.03499       0.03075        1.13758     3 2 2
 11     -0.05782       0.03081       -1.87632     3 3 3

 12      0.05412       0.04721        1.14616     4 1 1
 13     -0.00779       0.04846       -0.16072     4 2 2
 14     -0.05128       0.05056       -1.01423     4 3 3
 15     -0.02638       0.04888       -0.53976     4 4 4
 16      0.03133       0.04890        0.64080     4 5 5

 17     -2.31444       0.08627      -26.82712     NONE
```

The standard errors here are within the recommended value for main effects (0.05).

ANNEX 1.3: ALTERNATIVE MODEL SPECIFICATIONS

A range of model forms were tested using logistic regression. The model forms are summarised in Figure 1.3.1. Figures 1.3.2 and 1.3.3 summarise the outputs.

Model	Form
1	$Uj = a0 + b1j * duration + b2j * frequency + cj * price + d * (don't\ know)$
2	$Uj = b1j * duration + b2j * frequency + cj * price + d * (don't\ know)$
3	$Uj = b1j * duration + b2j * frequency + b2j * (duration * frequency) + cj * price + d * (don't\ know)$
4	$Uj = a0 + b1j * \ln(duration) + b2j * (\ln(duration) * freq2 - 3) + b3j * (\ln(duration) * freq4 - 6) + b4j * (\ln(duration) * freq7 - 14) + b5j * (\ln(duration) * freq15 +) + cj * price + d * (don't\ know)$
5	$Uj = b1j * \ln(duration) + b2j * (\ln(duration) * freq2 - 3) + b3j * (\ln(duration) * freq4 - 6) + b4j * (\ln(duration) * freq7 - 14) + b5j * (\ln(duration) * freq15 +) + cj * price + d * (don't\ know)$
6	$Uj = a0 + b1j * \ln(duration) + b1bj * frequency + b2j * (\ln(duration) * freq2 - 3) + b3j * (\ln(duration) * freq4 - 6) + b4j * (\ln(duration) * freq7 - 14) + b5j * (\ln(duration) * freq15 +) + cj * price + d * (don't\ know)$
7	$Uj = b1j * \ln(duration) + b1bj * frequency + b2j * (\ln(duration) * freq2 - 3) + b3j * (\ln(duration) * freq4 - 6) + b4j * (\ln(duration) * freq7 - 14) + b5j * (\ln(duration) * freq15 +) + cj * price + d * (don't\ know)$

Model 5 was selected for the following reasons:

- The coefficients have the expected signs and order of magnitude – the coefficient for the '2-3 times' frequency, though positive, is not significantly different from zero
- The models perform relatively well for both domestic and SME
- The approach is consistent with the model form used in the LE study, when the pilot surveys included frequency.

Figure 1.3.2: Logistic regression models – domestic WTA unplanned

	MODEL 1				MODEL 2				MODEL 3				MODEL 4			
	DURATION (LN), FREQUENCY, PRICE, CONSTANT				DURATION (LN), FREQUENCY, PRICE, NO CONSTANT				DURATION (LN), FREQUENCY, DURATION (LN) * FREQUENCY, PRICE, NO CONSTANT				DURATION (LN), DURATION (LN) * FREQUENCY (0,1 DUMMIES), PRICE, CONSTANT			
	B	S.E.	Wald	Sig.	B	S.E.	Wald	Sig.	B	S.E.	Wald	Sig.	B	S.E.	Wald	Sig.
Ln(duration) (1,20,120,240,960)	-0.2085	0.0046	2079.8	0.0000	-0.1744	0.0038	2057.3	0.0000	-0.1460	0.0049	876.3	0.0000	-0.1616	0.0062	674.4	0.0000
Frequency (1, 2.5, 5, 10.5, 15)	-0.0578	0.0021	779.4	0.0000	-0.0446	0.0018	589.7	0.0000	-0.0232	0.0030	59.8	0.0000	0.0000	0.0000	0.0	0.0000
Bill Compensation (£1, £5, £10, £12, £15)	0.0606	0.0021	816.0	0.0000	0.0779	0.0017	2041.8	0.0000	0.0710	0.0019	1418.2	0.0000	0.0603	0.0021	806.0	0.0000
Ln(duration) * Frequency (events per 3 years)	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	-0.0067	0.0007	80.7	0.0000	0.0000	0.0000	0.0	0.0000
Ln(duration) * freq2_3 (2-3 times in 3 years)	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	0.0059	0.0070	0.7	0.3981
Ln(duration) * freq4_6 (4-6 times in 3 years)	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	-0.0249	0.0072	11.9	0.0006
Ln(duration) * freq7-14 (7 to 14 times in 3 years)	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	-0.1161	0.0074	248.5	0.0000
Ln(duration) * freq15+ (15 or more times in 3 years)	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	-0.1362	0.0075	330.3	0.0000
Freq2_3 (2-3 times in 3 years)	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000
Freq4_6 (4-6 times in 3 years)	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000
Freq7-14 (7 to 14 times in 3 years)	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000
Freq15+ (15 or more times in 3 years)	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000
Constant	0.4222	0.0302	195.8	0.0000	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	0.0638	0.0268	5.7	0.0172
Don't know	-2.3425	0.0368	4057.0	0.0000	-1.9203	0.0210	8339.9	0.0000	-1.9203	0.0210	8339.9	0.0000	-1.9841	0.0340	3396.2	0.0000
Nagelkerke R Square	21.7				32.6				32.7				21.4			
Overall % correct	72.1				71.9				72.0				71.8			
% Chosen correct	43.2				37.8				41.0				44.4			

	MODEL 5				MODEL 6				MODEL 7			
	DURATION (LN), DURATION (LN) * FREQUENCY (0,1 DUMMIES), PRICE, NO CONSTANT				DURATION (LN), FREQUENCY, DURATION (LN) * FREQUENCY (0,1 DUMMIES), PRICE, NO CONSTANT				DURATION (LN), FREQUENCY, DURATION (LN) * (REDUCED) FREQUENCY (0,1 DUMMIES), PRICE, NO CONSTANT			
	B	S.E.	Wald	Sig.	B	S.E.	Wald	Sig.	B	S.E.	Wald	Sig.
Ln(duration) (1,20,120,240,960)	-0.1554	0.0057	755.1	0.0000	-0.1634	0.0058	801.9	0.0000	-0.1609	0.0040	1599.1	0.0000
Frequency (1, 2.5, 5, 10.5, 15)	0.0000	0.0000	0.0	0.0000	-0.0239	0.0030	63.3	0.0000	-0.0249	0.0028	77.1	0.0000
Bill Compensation (£1, £5, £10, £12, £15)	0.0636	0.0016	1515.4	0.0000	0.0710	0.0019	1411.8	0.0000	0.0715	0.0019	1482.5	0.0000
Ln(duration) * Frequency (events per 3 years)	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000
Ln(duration) * freq2_3 (2-3 times in 3 years)	0.0057	0.0070	0.7	0.4166	0.0112	0.0070	2.5	0.1121	0.0000	0.0000	0.0	0.0000
Ln(duration) * freq4_6 (4-6 times in 3 years)	-0.0236	0.0072	10.7	0.0011	-0.0037	0.0076	0.2	0.6282	0.0000	0.0000	0.0	0.0000
Ln(duration) * freq7-14 (7 to 14 times in 3 years)	-0.1159	0.0074	247.3	0.0000	-0.0738	0.0091	66.2	0.0000	-0.0752	0.0073	104.9	0.0000
Ln(duration) * freq15+ (15 or more times in 3 years)	-0.1351	0.0075	326.5	0.0000	-0.0691	0.0111	38.6	0.0000	-0.0696	0.0093	56.7	0.0000
Freq2_3 (2-3 times in 3 years)	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000
Freq4_6 (4-6 times in 3 years)	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000
Freq7-14 (7 to 14 times in 3 years)	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000
Freq15+ (15 or more times in 3 years)	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000
Constant	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000
Don't know	-1.9203	0.0210	8339.9	0.0000	-1.9203	0.0210	8339.9	0.0000	-1.9203	0.0210	8339.9	0.0000
Nagelkerke R Square	32.6				32.8				32.7			
Overall % correct	71.8				72.1				72.1			
% Chosen correct	44.4				42.3				42.3			

	WTA	VoLL	Lower	Upper	WTA	VoLL	Lower	Upper	WTA	VoLL	Lower	Upper	WTA	VoLL	Lower	Upper
1.0 hrs duration, once every 3 years	£11.27	**£25,021**	*£23,167*	*£26,875*	£7.27	**£16,150**	*£15,239*	*£17,061*	£6.77	**£15,038**	*£13,885*	*£16,191*	£8.02	**£17,814**	*£15,992*	*£19,636*
1.0 hrs duration, 2-3 times in 3 years	£12.70	£28,199	*£26,345*	*£30,053*	£8.13	£18,055	*£17,144*	*£18,967*	£7.68	£17,063	*£15,911*	*£18,216*	£8.02	£17,814	*£14,729*	*£20,899*
1.0 hrs duration, 4-6 times in 3 years	£15.08	£33,495	*£31,641*	*£35,349*	£9.56	£21,231	*£20,320*	*£22,142*	£9.20	£20,439	*£19,286*	*£21,592*	£9.26	£20,564	*£17,330*	*£23,798*
1.0 hrs duration, 7-14 (7 to 14 times in 3 years	£19.85	£44,088	*£42,234*	*£45,942*	£12.42	£27,581	*£26,670*	*£28,492*	£12.24	£27,190	*£26,037*	*£28,343*	£13.79	£30,615	*£26,997*	*£34,232*
1.0 hrs duration, 15 or more times in 3 years	£24.62	£54,681	*£52,827*	*£56,535*	£15.28	£33,932	*£33,020*	*£34,843*	£15.28	£33,941	*£32,789*	*£35,094*	£14.78	£32,827	*£29,096*	*£36,558*
6.0 hrs duration, once every 3 years	£17.44	£38,719	*£35,756*	*£41,682*	£11.28	£25,050	*£23,594*	*£26,506*	£10.63	£23,598	*£21,756*	*£25,440*	£12.82	£28,469	*£25,557*	*£31,381*
6.0 hrs duration, 2-3 times in 3 years	£18.87	£41,897	*£38,934*	*£44,860*	£12.14	£26,955	*£25,499*	*£28,411*	£11.79	£26,183	*£24,341*	*£28,026*	£12.82	£28,469	*£23,539*	*£33,399*
6.0 hrs duration, 4-6 times in 3 years	£21.25	£47,193	*£44,230*	*£50,157*	£13.57	£30,131	*£28,675*	*£31,587*	£13.73	£30,492	*£28,650*	*£32,335*	£14.80	£32,863	*£27,696*	*£38,031*
6.0 hrs duration, 7-14 (7 to 14 times in 3 years	£26.02	£57,786	*£54,823*	*£60,749*	£16.43	£36,481	*£35,025*	*£37,937*	£17.61	£39,110	*£37,268*	*£40,953*	£22.03	£48,925	*£43,144*	*£54,707*
6.0 hrs duration, 15 or more times in 3 years	£30.79	£68,379	*£65,415*	*£71,342*	£19.29	£42,831	*£41,375*	*£44,287*	£21.49	£47,728	*£45,886*	*£49,571*	£23.62	£52,461	*£46,498*	*£58,423*
12.0 hrs duration, once every 3 years	£19.82	£44,018	*£40,626*	*£47,410*	£12.83	£28,493	*£26,826*	*£30,160*	£12.12	£26,910	*£24,801*	*£29,018*	£14.68	£32,591	*£29,257*	*£35,925*
12.0 hrs duration, 2-3 times in 3 years	£21.25	£47,196	*£43,804*	*£50,588*	£13.69	£30,398	*£28,732*	*£32,065*	£13.38	£29,712	*£27,603*	*£31,820*	£14.68	£32,591	*£26,947*	*£38,235*
12.0 hrs duration, 4-6 times in 3 years	£23.64	£52,492	*£49,100*	*£55,885*	£15.12	£33,574	*£31,907*	*£35,240*	£15.48	£34,382	*£32,273*	*£36,491*	£16.94	£37,621	*£31,706*	*£43,537*
12.0 hrs duration, 7-14 (7 to 14 times in 3 years	£28.41	£63,085	*£59,693*	*£66,477*	£17.98	£39,924	*£38,257*	*£41,591*	£19.69	£43,722	*£41,613*	*£45,831*	£25.22	£56,009	*£49,390*	*£62,628*
12.0 hrs duration, 15 or more times in 3 years	£33.18	£73,678	*£70,286*	*£77,070*	£20.84	£46,274	*£44,608*	*£47,941*	£23.89	£53,062	*£50,953*	*£55,171*	£27.04	£60,056	*£53,231*	*£66,881*
48.0 hrs duration, once every 3 years	£24.59	£54,616	*£50,366*	*£58,867*	£15.93	£35,379	*£33,291*	*£37,468*	£15.10	£33,532	*£30,890*	*£36,175*	£18.39	£40,835	*£36,658*	*£45,012*
48.0 hrs duration, 2-3 times in 3 years	£26.03	£57,794	*£53,544*	*£62,045*	£16.79	£37,284	*£35,196*	*£39,373*	£16.56	£36,768	*£34,125*	*£39,410*	£18.39	£40,835	*£33,763*	*£47,906*
48.0 hrs duration, 4-6 times in 3 years	£28.41	£63,091	*£58,840*	*£67,341*	£18.22	£40,459	*£38,371*	*£42,548*	£18.99	£42,160	*£39,518*	*£44,802*	£21.23	£47,138	*£39,725*	*£54,550*
48.0 hrs duration, 7-14 (7 to 14 times in 3 years	£33.18	£73,683	*£69,433*	*£77,934*	£21.08	£46,810	*£44,721*	*£48,898*	£23.84	£52,944	*£50,302*	*£55,587*	£31.60	£70,176	*£61,883*	*£78,469*
48.0 hrs duration, 15 or more times in 3 years	£37.95	£84,276	*£80,026*	*£88,527*	£23.94	£53,160	*£51,072*	*£55,249*	£28.70	£63,729	*£61,086*	*£66,371*	£33.89	£75,247	*£66,695*	*£83,799*

	WTA	VoLL	Lower	Upper	WTA	VoLL	Lower	Upper	WTA	VoLL	Lower	Upper
1.0 hrs duration, once every 3 years	£7.32	**£16,257**	*£14,838*	*£17,677*	£7.23	**£16,048**	*£14,722*	*£17,374*	£7.09	**£15,740**	*£14,682*	*£16,798*
1.0 hrs duration, 2-3 times in 3 years	£7.32	£16,257	*£13,553*	*£18,962*	£7.73	£17,169	*£14,707*	*£19,631*	£7.61	£16,897	*£15,840*	*£17,955*
1.0 hrs duration, 4-6 times in 3 years	£8.43	£18,724	*£15,923*	*£21,524*	£8.57	£19,037	*£16,444*	*£21,630*	£8.48	£18,826	*£17,769*	*£19,884*
1.0 hrs duration, 7-14 (7 to 14 times in 3 years	£12.78	£28,380	*£25,351*	*£31,409*	£13.37	£29,682	*£26,723*	*£32,641*	£13.37	£29,681	*£27,327*	*£32,036*
1.0 hrs duration, 15 or more times in 3 years	£13.69	£30,398	*£27,300*	*£33,496*	£14.85	£32,984	*£29,681*	*£36,287*	£14.87	£33,020	*£30,365*	*£35,675*
6.0 hrs duration, once every 3 years	£11.70	£25,981	*£23,713*	*£28,249*	£11.35	£25,199	*£23,080*	*£27,318*	£11.12	£24,692	*£23,002*	*£26,383*
6.0 hrs duration, 2-3 times in 3 years	£11.70	£25,981	*£21,658*	*£30,304*	£11.85	£26,320	*£22,385*	*£30,255*	£11.64	£25,850	*£24,159*	*£27,540*
6.0 hrs duration, 4-6 times in 3 years	£13.47	£29,922	*£25,447*	*£34,397*	£12.69	£28,188	*£24,044*	*£32,332*	£12.51	£27,779	*£26,089*	*£29,469*
6.0 hrs duration, 7-14 (7 to 14 times in 3 years	£20.42	£45,354	*£40,514*	*£50,195*	£19.35	£42,966	*£38,237*	*£47,695*	£19.28	£42,819	*£39,055*	*£46,582*
6.0 hrs duration, 15 or more times in 3 years	£21.88	£48,579	*£43,628*	*£53,529*	£20.72	£46,008	*£40,730*	*£51,286*	£20.65	£45,846	*£41,603*	*£50,089*
12.0 hrs duration, once every 3 years	£13.39	£29,743	*£27,146*	*£32,339*	£12.94	£28,739	*£26,313*	*£31,165*	£12.68	£28,156	*£26,221*	*£30,091*
12.0 hrs duration, 2-3 times in 3 years	£13.39	£29,743	*£24,794*	*£34,691*	£13.45	£29,860	*£25,356*	*£34,365*	£13.20	£29,313	*£27,378*	*£31,248*
12.0 hrs duration, 4-6 times in 3 years	£15.43	£34,254	*£29,132*	*£39,377*	£14.29	£31,728	*£26,984*	*£36,472*	£14.07	£31,242	*£29,307*	*£33,177*
12.0 hrs duration, 7-14 (7 to 14 times in 3 years	£23.38	£51,921	*£46,380*	*£57,462*	£21.66	£48,105	*£42,691*	*£53,519*	£21.57	£47,901	*£43,593*	*£52,209*
12.0 hrs duration, 15 or more times in 3 years	£25.04	£55,612	*£49,944*	*£61,279*	£22.99	£51,046	*£45,004*	*£57,088*	£22.88	£50,808	*£45,951*	*£55,665*
48.0 hrs duration, once every 3 years	£16.78	£37,266	*£34,012*	*£40,519*	£16.13	£35,820	*£32,780*	*£38,860*	£15.80	£35,082	*£32,658*	*£37,507*
48.0 hrs duration, 2-3 times in 3 years	£16.78	£37,266	*£31,066*	*£43,466*	£16.64	£36,941	*£31,297*	*£42,584*	£16.32	£36,240	*£33,815*	*£38,664*
48.0 hrs duration, 4-6 times in 3 years	£19.33	£42,919	*£36,500*	*£49,337*	£17.48	£38,809	*£32,865*	*£44,753*	£17.19	£38,169	*£35,744*	*£40,594*
48.0 hrs duration, 7-14 (7 to 14 times in 3 years	£29.30	£65,054	*£58,112*	*£71,997*	£26.29	£58,383	*£51,600*	*£65,166*	£26.15	£58,065	*£52,667*	*£63,463*
48.0 hrs duration, 15 or more times in 3 years	£31.38	£69,679	*£62,578*	*£76,780*	£27.52	£61,123	*£53,552*	*£68,693*	£27.35	£60,732	*£54,646*	*£66,818*

Figure 1.3.3: Logistic regression models – SME WTA unplanned

	MODEL 1				MODEL 2				MODEL 3				MODEL 4			
	DURATION (LN), FREQUENCY, PRICE, CONSTANT				DURATION (LN), FREQUENCY, PRICE, NO CONSTANT				DURATION (LN), FREQUENCY, DURATION (LN) * FREQUENCY, PRICE, NO CONSTANT				DURATION (LN), DURATION (LN) * FREQUENCY (0,1 DUMMIES), PRICE, CONSTANT			
	B	S.E.	Wald	Sig.	B	S.E.	Wald	Sig.	B	S.E.	Wald	Sig.	B	S.E.	Wald	Sig.
Ln(duration) (1,20,120,240,960)	-0.2383	0.0109	475.6	0.0000	-0.1168	0.0081	206.9	0.0000	-0.0197	0.0110	3.2	0.0730	-0.1402	0.0143	96.3	0.0000
Frequency (1, 2.5, 5, 10.5, 15)	-0.0599	0.0047	163.3	0.0000	-0.0189	0.0040	22.6	0.0000	0.0475	0.0067	50.9	0.0000	0.0000	0.0000	0.0	0.0000
Bill Compensation (1%, 5%, 10%, 12%, 15%)	-0.0072	0.0049	2.2	0.1413	0.0452	0.0038	139.1	0.0000	0.0200	0.0043	21.6	0.0000	-0.0126	0.0050	6.3	0.0118
Ln(duration) * Frequency (events per 3 years)	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	-0.0218	0.0017	161.1	0.0000	0.0000	0.0000	0.0	0.0000
Ln(duration) * freq2_3 (2-3 times in 3 years)	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	-0.0156	0.0165	0.9	0.3441
Ln(duration) * freq4_6 (4-6 times in 3 years)	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	-0.1444	0.0167	74.7	0.0000
Ln(duration) * freq7-14 (7 to 14 times in 3 years)	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	-0.1485	0.0167	78.8	0.0000
Ln(duration) * freq15+ (15 or more times in 3 years)	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	-0.1927	0.0172	125.8	0.0000
Freq2_3 (2-3 times in 3 years)	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000
Freq4_6 (4-6 times in 3 years)	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000
Freq7-14 (7 to 14 times in 3 years)	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000
Freq15+ (15 or more times in 3 years)	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000
Constant	1.3471	0.0779	299.3	0.0000	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	0.9807	0.0679	208.9	0.0000
Don't know	-4.6114	0.1171	1551.1	0.0000	-3.2643	0.0874	1393.4	0.0000	-3.2643	0.0874	1393.4	0.0000	-4.2450	0.1107	1470.8	0.0000
Nagelkerke R Square	36.3				42.8				44.2				36.7			
Overall % correct	74.0				72.0				72.6				73.0			
% Chosen correct	49.7				37.5				47.3				56.6			

	MODEL 5				MODEL 6				MODEL 7				MODEL 8			
	DURATION (LN), DURATION (LN) * FREQUENCY (0,1 DUMMIES), PRICE, NO CONSTANT				DURATION (LN), FREQUENCY, DURATION (LN) * FREQUENCY (0,1 DUMMIES), PRICE, NO CONSTANT				DURATION (LN), FREQUENCY, DURATION (LN) * (REDUCED) FREQUENCY (0,1 DUMMIES), PRICE, NO CONSTANT				DURATION (LN), DURATION (LN) * FREQUENCY (0,1 DUMMIES), (REDUCED) PRICE, NO CONSTANT			
	B	S.E.	Wald	Sig.	B	S.E.	Wald	Sig.	B	S.E.	Wald	Sig.	B	S.E.	Wald	Sig.
Ln(duration) (1,20,120,240,960)	-0.0538	0.0129	17.5	0.0000	-0.0307	0.0132	5.4	0.0203	-0.0375	0.0101	13.7	0.0002	-0.1130	0.0147	59.0	0.0000
Frequency (1, 2.5, 5, 10.5, 15)	0.0000	0.0000	0.0	0.0000	0.0483	0.0067	52.1	0.0000	0.0474	0.0066	51.7	0.0000	0.0000	0.0000	0.0	0.0000
Bill Compensation (1%, 5%, 10%, 12%, 15%)	0.0377	0.0036	111.9	0.0000	0.0196	0.0043	20.5	0.0000	0.0201	0.0043	22.0	0.0000	0.0575	0.0042	190.3	0.0000
Ln(duration) * Frequency (events per 3 years)	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000
Ln(duration) * freq2_3 (2-3 times in 3 years)	0.0061	0.0164	0.14	0.7088	-0.0132	0.0165	0.6	0.4249	0.0000	0.0000	0.0	0.0000	0.0163	0.0185	0.8	0.3796
Ln(duration) * freq4_6 (4-6 times in 3 years)	-0.1078	0.0164	43.2	0.0000	-0.1521	0.0175	75.5	0.0000	-0.1452	0.0152	90.9	0.0000	-0.1086	0.0180	36.6	0.0000
Ln(duration) * freq7-14 (7 to 14 times in 3 years)	-0.1244	0.0165	56.7	0.0000	-0.2146	0.0208	107.0	0.0000	-0.2069	0.0183	127.2	0.0000	-0.1398	0.0194	52.2	0.0000
Ln(duration) * freq15+ (15 or more times in 3 years)	-0.1640	0.0170	93.0	0.0000	-0.3052	0.0260	137.4	0.0000	-0.2967	0.0237	156.5	0.0000	-0.1934	0.0191	102.8	0.0000
Freq2_3 (2-3 times in 3 years)	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000
Freq4_6 (4-6 times in 3 years)	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000
Freq7-14 (7 to 14 times in 3 years)	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000
Freq15+ (15 or more times in 3 years)	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000
Constant	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000	0.0000	0.0000	0.0	0.0000
Don't know	-3.2643	0.0874	1393.4	0.0000	-3.2643	0.0874	1393.4	0.0000	-3.2643	0.0874	1393.4	0.0000	-3.2643	0.0874	1393.4	0.0000
Nagelkerke R Square	44.0				44.4				44.4				50.2			
Overall % correct	73.0				72.5				72.4				75.9			
% Chosen correct	49.4				51.4				50.3				52.3			

	MODEL 1				MODEL 2				MODEL 3				MODEL 4			
	WTA	**VoLL**	**Lower**	**Upper**	**WTA**	**VoLL**	**Lower**	**Upper**	**WTA**	**VoLL**	**Lower**	**Upper**	**WTA**	**VoLL**	**Lower**	**Upper**
1.0 hrs duration, once every 3 years	-£2,673				£204	**£60,740**	*£48,354*	*£73,127*	£96	**£28,515**	*£2,811*	*£54,218*	-£836			
1.0 hrs duration, 2-3 times in 3 years	-£2,983				£220	£65,403	*£53,017*	*£77,790*	£129	£38,386	*£12,682*	*£64,090*	-£836			
1.0 hrs duration, 4-6 times in 3 years	-£3,500				£246	£73,175	*£60,789*	*£85,562*	£184	£54,838	*£29,134*	*£80,541*	-£1,696			
1.0 hrs duration, 7-14 (7 to 14 times in 3 years	-£4,534				£298	£88,719	*£76,333*	*£101,106*	£295	£87,741	*£62,037*	*£113,445*	-£1,721			
1.0 hrs duration, 15 or more times in 3 years	-£5,568				£350	£104,263	*£91,877*	*£116,649*	£405	£120,645	*£94,941*	*£146,348*	-£1,985			
6.0 hrs duration, once every 3 years	-£4,148				£320	£95,210	*£75,415*	*£115,005*	£189	£56,145	*£15,067*	*£97,222*	-£1,335			
6.0 hrs duration, 2-3 times in 3 years	-£4,458				£336	£99,873	*£80,078*	*£119,668*	£295	£87,782	*£46,705*	*£128,860*	-£1,335			
6.0 hrs duration, 4-6 times in 3 years	-£4,975				£362	£107,645	*£87,850*	*£127,440*	£472	£140,512	*£99,435*	*£181,589*	-£2,711			
6.0 hrs duration, 7-14 (7 to 14 times in 3 years	-£6,009				£414	£123,189	*£103,394*	*£142,984*	£826	£245,971	*£204,894*	*£287,048*	-£2,750			
6.0 hrs duration, 15 or more times in 3 years	-£7,043				£466	£138,733	*£118,938*	*£158,527*	£1,181	£351,430	*£310,353*	*£392,507*	-£3,172			
12.0 hrs duration, once every 3 years	-£4,718				£365	£108,545	*£85,884*	*£131,205*	£225	£66,833	*£19,809*	*£113,858*	-£1,529			
12.0 hrs duration, 2-3 times in 3 years	-£5,028				£380	£113,208	*£90,547*	*£135,868*	£359	£106,892	*£59,867*	*£153,916*	-£1,529			
12.0 hrs duration, 4-6 times in 3 years	-£5,545				£406	£120,980	*£98,319*	*£143,640*	£583	£173,655	*£126,631*	*£220,680*	-£3,104			
12.0 hrs duration, 7-14 (7 to 14 times in 3 years	-£6,579				£459	£136,523	*£113,863*	*£159,184*	£1,032	£307,183	*£260,158*	*£354,207*	-£3,149			
12.0 hrs duration, 15 or more times in 3 years	-£7,613				£511	£152,067	*£129,407*	*£174,728*	£1,481	£440,710	*£393,686*	*£487,735*	-£3,631			
48.0 hrs duration, once every 3 years	-£5,859				£454	£135,214	*£106,821*	*£163,607*	£296	£88,211	*£29,292*	*£147,130*	-£1,915			
48.0 hrs duration, 2-3 times in 3 years	-£6,169				£470	£139,877	*£111,484*	*£168,270*	£488	£145,110	*£86,191*	*£204,029*	-£1,915			
48.0 hrs duration, 4-6 times in 3 years	-£6,686				£496	£147,649	*£119,256*	*£176,042*	£806	£239,942	*£181,023*	*£298,861*	-£3,889			
48.0 hrs duration, 7-14 (7 to 14 times in 3 years	-£7,720				£548	£163,193	*£134,800*	*£191,585*	£1,443	£429,606	*£370,687*	*£488,525*	-£3,945			
48.0 hrs duration, 15 or more times in 3 years	-£8,754				£600	£178,737	*£150,344*	*£207,129*	£2,081	£619,270	*£560,351*	*£678,189*	-£4,549			

	MODEL 5				MODEL 6				MODEL 7				MODEL 8			
	WTA	**VoLL**	**Lower**	**Upper**	**WTA**	**VoLL**	**Lower**	**Upper**	**WTA**	**VoLL**	**Lower**	**Upper**	**WTA**	**VoLL**	**Lower**	**Upper**
1.0 hrs duration, once every 3 years	£107	**£31,815**	*£15,776*	*£47,855*	£56	**£16,546**	*-£16,554*	*£49,646*	£81	**£23,974**	*-£4,011*	*£51,959*	£147	**£43,787**	*£30,997*	*£56,576*
1.0 hrs duration, 2-3 times in 3 years	£107	£31,815	*-£2,506*	*£66,137*	-£37	-£10,941	*-£80,709*	*£58,827*	-£8	-£2,347	*-£30,332*	*£25,637*	£147	£43,787	*£17,993*	*£69,581*
1.0 hrs duration, 4-6 times in 3 years	£321	£95,625	*£57,325*	*£133,925*	£390	£116,219	*£3,154*	*£229,284*	£386	£114,777	*£13,879*	*£215,675*	£288	£85,857	*£58,209*	*£113,506*
1.0 hrs duration, 7-14 (7 to 14 times in 3 years	£354	£105,417	*£66,141*	*£144,693*	£321	£95,689	*-£46,840*	*£238,217*	£320	£95,396	*-£33,489*	*£224,282*	£329	£97,970	*£68,589*	*£127,351*
1.0 hrs duration, 15 or more times in 3 years	£433	£128,832	*£86,767*	*£170,897*	£360	£107,087	*-£79,997*	*£294,171*	£360	£107,171	*-£64,045*	*£278,387*	£399	£118,720	*£88,014*	*£149,425*
6.0 hrs duration, once every 3 years	£171	£50,844	*£25,212*	*£76,477*	£126	£37,402	*-£15,495*	*£90,299*	£164	£48,808	*£4,085*	*£93,530*	£235	£69,976	*£49,537*	*£90,415*
6.0 hrs duration, 2-3 times in 3 years	£171	£50,844	*-£4,006*	*£105,694*	£33	£9,915	*-£101,581*	*£121,412*	£76	£22,487	*-£22,236*	*£67,209*	£235	£69,976	*£28,754*	*£111,197*
6.0 hrs duration, 4-6 times in 3 years	£513	£152,818	*£91,611*	*£214,026*	£808	£240,530	*£59,840*	*£421,220*	£793	£235,901	*£74,656*	*£397,147*	£461	£137,209	*£93,024*	*£181,395*
6.0 hrs duration, 7-14 (7 to 14 times in 3 years	£566	£168,467	*£105,700*	*£231,234*	£882	£262,520	*£34,745*	*£490,296*	£865	£257,404	*£51,432*	*£463,377*	£526	£156,566	*£109,613*	*£203,520*
6.0 hrs duration, 15 or more times in 3 years	£692	£205,887	*£138,662*	*£273,111*	£1,127	£335,536	*£36,557*	*£634,516*	£1,104	£328,697	*£55,076*	*£602,318*	£637	£189,726	*£140,656*	*£238,797*
12.0 hrs duration, once every 3 years	£196	£58,206	*£28,862*	*£87,549*	£153	£45,470	*-£15,085*	*£106,026*	£196	£58,415	*£7,217*	*£109,612*	£269	£80,107	*£56,709*	*£103,505*
12.0 hrs duration, 2-3 times in 3 years	£196	£58,206	*-£4,586*	*£120,997*	£60	£17,983	*-£109,656*	*£145,623*	£108	£32,094	*-£19,104*	*£83,291*	£269	£80,107	*£32,917*	*£127,296*
12.0 hrs duration, 4-6 times in 3 years	£588	£174,944	*£104,875*	*£245,013*	£970	£288,620	*£81,769*	*£495,471*	£950	£282,758	*£98,167*	*£467,350*	£528	£157,075	*£106,492*	*£207,658*
12.0 hrs duration, 7-14 (7 to 14 times in 3 years	£648	£192,858	*£121,003*	*£264,712*	£1,099	£327,060	*£66,306*	*£587,813*	£1,075	£320,078	*£84,284*	*£555,872*	£602	£179,235	*£125,483*	*£232,986*
12.0 hrs duration, 15 or more times in 3 years	£792	£235,696	*£158,738*	*£312,653*	£1,424	£423,913	*£81,646*	*£766,179*	£1,392	£414,395	*£101,158*	*£727,632*	£730	£217,195	*£161,020*	*£273,371*
48.0 hrs duration, once every 3 years	£245	£72,928	*£36,163*	*£109,694*	£207	£61,607	*-£14,265*	*£137,479*	£261	£77,629	*£13,481*	*£141,777*	£337	£100,369	*£71,053*	*£129,686*
48.0 hrs duration, 2-3 times in 3 years	£245	£72,928	*-£5,745*	*£151,602*	£115	£34,120	*-£125,805*	*£194,045*	£172	£51,308	*-£12,840*	*£115,456*	£337	£100,369	*£41,244*	*£159,495*
48.0 hrs duration, 4-6 times in 3 years	£736	£219,195	*£131,402*	*£306,987*	£1,293	£384,800	*£125,628*	*£643,973*	£1,265	£376,473	*£145,191*	*£607,755*	£661	£196,806	*£133,428*	*£260,183*
48.0 hrs duration, 7-14 (7 to 14 times in 3 years	£812	£241,640	*£151,610*	*£331,670*	£1,532	£456,138	*£129,429*	*£782,847*	£1,496	£445,424	*£149,988*	*£740,861*	£754	£224,571	*£157,223*	*£291,919*
48.0 hrs duration, 15 or more times in 3 years	£992	£295,313	*£198,890*	*£391,737*	£2,018	£600,665	*£171,824*	*########*	£1,968	£585,791	*£193,323*	*£978,260*	£914	£272,134	*£201,749*	*£342,518*

ANNEX 1.4: SECONDARY ‘MITIGATION’ DISCRETE CHOICE EXERCISE

Attributes

The initiatives that DNOs could undertake to mitigate the dis-benefits of outages and tested in the research are summarised in the table below.

Figure 1.4.1: Attributes and levels tested in the secondary choice experiment

Service attribute	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
Assistance for customers vulnerable during the power cut/s	Home visits *(to offer help and advice)*	A welfare pack to help cope with the power cut *(might include: a blanket, hand warmer, baby bottle warmer, hot flask, analogue telephone or a wind up torch)*	Generator *(to provide a partial supply for essential medical equipment, appliances and lights)*	Sending a mobile catering van *(to provide hot food and drinks)*	Sending a mobile charging unit *(to charge mobile phones and tablet devices)*	None	
Proactive information about the power cut/s	Updates sent to a nominated friend or family member *(instead of or in addition to you)*	Phone call(s) made to your mobile or landline *(with updates and details of changes)*	SMS (short message service) *Updates and details of changes sent to your mobile phone*	Automated text-to-speech message *(computer-generated spoken voice update sent to your landline phone)*	Social media *(Twitter, Facebook etc.) (with updates and details of changes)*	Public address/tannoy system *(with updates and details of changes)*	No proactive updates
Quality of information provided	A justified reason for the power cut	Accurate information confirming when power will be restored	An indication of the number of properties affected by the power cut	Information about the area affected by the power cut	Advice about what to do during a power cut *(eg with alarms, freezers, specific equipment)*	Confirmation that your electricity is back on *(for people that go out or businesses that close during a power cut)*	No information provided

Experimental designs

So that these scenarios could be inter-leaved with the main discrete choice exercise, designs with the same numbers of scenarios as the main design were developed. That is, domestic respondents had a design of 27 blocks of six scenarios in each, one design for WTP and one for WTA. SME respondents had a design of nine blocks of six scenarios.

The discrete choice exercise

The tables below give examples of how the secondary scenarios were presented, with each one appearing immediately after a single WTP or WTA scenario respectively. On the same screen, respondents were reminded of the choice they had made from the preceding scenario, for example the choice shown in Figure 1.3 of the main body of this report, where the selection was for: *advanced warning of 14 days' notice, seven or more power cuts, one hour per power cut and a cost of £10.*

Figure 1.4.2: Example 'secondary' scenario for domestic customer (planned outage – WTP) (shown with details of the option selected in the preceding scenario from the main CE).

Below are possible types of ***support** that you could receive during the above power cut*, please choose the support option you prefer:

WTP	Support A	Support B	
Quality of information provided	**Advice about what to do during a power cut** (eg with alarms, freezers, specific equipment)	**Information about the area affected by the power cut**	Not sure
Proactive information about the power cut/s	**Updates sent to a nominated friend or family member** (instead of or in addition to you)	**SMS** (short message service) Updates and details of changes sent to your mobile phone	
Assistance for customers vulnerable during the power cut/s	None	None	
Additional payment you make for support	No extra cost to you	Extra cost to you: £2	
Please make your selection here:	○	◉	○

Figure 1.4.3: Example 'secondary' scenario for SME customer (unplanned outage – WTA) (shown with details of the option selected in the preceding scenario from the main discrete choice exercise).

Below are possible types of ***support*** *that you could receive during the above power cut,* please choose the support option you prefer:

WTA	Support A	Support B	
Quality of information provided	No information provided	**A justified reason for the power cut**	Not sure
Proactive information about the power cut/s	No proactive updates	**Public address/tannoy system** (with updates and details of changes)	
Assistance for customers vulnerable during the power cut/s	**Sending a mobile charging unit** (allowing you to charge mobile phones and tablet devices)	None	
The extra payment you would get with this support	Extra payment to you: 3% of your annual electricity bill	No extra payment to you	
Please make your selection here:	◉	○	○