

Appendix C: Econometric modelling

Choice model specification

Each participant completed six tasks, each of which presented four alternatives - a free basic wallet, two wallets with additional innovative features which may have an associated monthly cost, and an opt-out option if they did not want to choose any of the wallets.

The choices were analysed using regression models, with their choice of wallet as the dependent variable (a 0/1 variable indicating which of the four alternatives was chosen). Our main model includes current users of digital wallets only, of whom there were 2,532 in the sample. With six choices apiece, this generated 15,138 tasks/choices to analyse.

To analyse the discrete choice experiment data, a mixed logit model was estimated. While a standard conditional logit model provides a baseline, it assumes preferences to be homogenous across all respondents. The mixed logit model was selected because it relaxes this assumption and explicitly accounts for unobserved preference heterogeneity by allowing the coefficients of the choice attributes to vary randomly across individuals.

Within the mixed logit, the coefficients for the product features and the opt-out alternative were specified as random parameters to capture the varying tastes of the population. The price coefficient was kept fixed to facilitate estimation of willingness-to-pay.¹

Sensitivity analyses

We conducted a number of sensitivity analyses on the main model to test its robustness, with results documented in this appendix.

Our primary model results rely on 1,000 Halton draws to maximise precision and stable standard errors. During initial testing, however, we verified that the model achieves good stability and consistent parameter behavior at lower draw counts (250 and 500) - the results of these are documented below in Table A2. Coefficients and standard errors were highly consistent between the models. We have therefore used models with 250 draws for subsequent sensitivity testing since this is more computationally efficient for testing multiple sensitivity models whilst maintaining an accurate model.

¹ Train and Weeks (2005) - Discrete Choice Models in Preference Space and Willingness-to-Pay Space, accessed at:
https://www.researchgate.net/publication/226411986_Discrete_Choice_Models_in_Preference_Space_and_Willingness-to-Pay_Space

Table A2: Model sensitivity tests using different numbers of draws in the mixed logit

	Variable	Main model (1000 draws)	Model 500 draws	Model 250 draws
Preference coefficients	Monthly subscription price	-1.386*** (0.022)	-1.384*** (0.023)	-1.377*** (0.022)
	Opt-out ASC	-11.409*** (0.563)	-10.943*** (0.530)	-10.959*** (0.526)
	Automatic loyalty points feature: ON	0.600*** (0.032)	0.611*** (0.032)	0.604*** (0.032)
	Receipt storage feature: ON	0.538*** (0.030)	0.544*** (0.030)	0.539*** (0.030)
	ID storage feature: ON	0.383*** (0.030)	0.390*** (0.030)	0.389*** (0.030)
	Flexible card feature: ON	0.362*** (0.033)	0.370*** (0.032)	0.372*** (0.032)
Model fit	Log-likelihood	-13542	-13549	-13555
Willingness-to-pay estimates for features	Receipt storage	£0.39 (£0.35-£0.43)	£0.39 (£0.35-£0.44)	£0.39 (£0.35-£0.43)
	ID storage	£0.28 (£0.23-£0.32)	£0.28 (£0.24-£0.32)	£0.28 (£0.24-£0.32)
	Automatic loyalty points	£0.43 (£0.39-£0.48)	£0.44 (£0.40-£0.49)	£0.44 (£0.39-£0.48)
	Flexible cards	£0.26 (£0.22-£0.31)	£0.27 (£0.22-£0.31)	£0.27 (£0.23-£0.32)

Sensitivity analysis with different numbers of model draws (Halton)

*Notes: Mixed logit model with normally distributed random coefficients for the four premium wallet features and opt-out ASC. Price treated as a fixed coefficient. * = $p < .05$, ** = $p < .01$, *** $p < .001$. Standard errors for the coefficient estimates are in brackets.*

Willingness-to-pay estimates are derived from the ratio of the feature and price coefficients. 95% confidence intervals for the willingness-to-pay estimates are in brackets.

Table A3 below tests the model with different exclusion criteria applied to the model. We tested the model excluding the fastest decile of respondents to ensure that the results are not distorted by respondents speeding through the tasks. We also tested the model excluding respondents with low self-reported understanding of the tasks, since they may have been less able to meaningfully compare choices.

Although these exclusions did affect the model coefficients slightly, the conclusions were substantively the same and the changes in the willingness-to-pay estimates were negligible, giving us confidence in the robustness of the main model.

Table A3: Model sensitivity tests using different respondent inclusion criteria

	Variable	Main model digital wallet users	Model excluding fastest 10% of respondents	Model excluding those with low self-reported understanding of task	Model excluding fastest 10% and those with low understandin g
Sample size		2,582	2,315	2,520	2,274
Preference coefficients	Monthly subscription price	-1.386*** (0.022)	-1.650*** (0.027)	-1.422*** (0.023)	-1.680*** (0.028)
	Opt-out ASC	-11.409*** (0.563)	-10.783*** (0.550)	-11.271*** (0.558)	-11.196*** (0.603)
	Automatic loyalty points feature: ON	0.600*** (0.032)	0.715*** (0.035)	0.638*** (0.033)	0.722*** (0.036)
	Receipt storage feature: ON	0.538*** (0.030)	0.635*** (0.033)	0.572*** (0.030)	0.647*** (0.033)
	ID storage feature: ON	0.383*** (0.030)	0.445*** (0.033)	0.414*** (0.031)	0.445*** (0.034)
	Flexible card feature: ON	0.362*** (0.033)	0.435*** (0.035)	0.387*** (0.033)	0.437*** (0.036)
Willingness to pay estimates for features	Receipt storage	£0.39 (£0.35-£0.43)	£0.39 (£0.35-£0.42)	£0.40 (£0.36-£0.44)	£0.39 (£0.35-£0.42)
	ID storage	£0.28 (£0.23-£0.32)	£0.27 (£0.23-£0.31)	£0.29 (£0.25-£0.33)	£0.27 (£0.23-£0.30)
	Automatic loyalty points	£0.43 (£0.39-£0.48)	£0.43 (£0.39-£0.47)	£0.45 (£0.40-£0.49)	£0.43 (£0.39-£0.47)
	Flexible cards	£0.26 (£0.22-£0.31)	£0.26 (£0.22-£0.31)	£0.27 (£0.23-£0.32)	£0.26 (£0.22-£0.30)

*Sensitivity analyses using alternative respondent inclusion criteria. Notes: Mixed logit model with normally distributed random coefficients for the four premium wallet features and opt-out ASC. Price treated as a fixed coefficient. * = $p < .05$, ** = $p < .01$, *** $p < .001$. Standard errors for the coefficient estimates are in brackets. Willingness-to-pay estimates are derived from the ratio of the feature and price coefficients. 95% confidence intervals for the willingness-to-pay estimates are in brackets.*

Segment analysis

The model findings found a high level of heterogeneity in preferences among consumers, and descriptive analysis of the data showed that age is a major factor in current usage levels of digital wallets and propensity to choose a paid wallet with innovative features. Income is also a likely factor in price sensitivity. Therefore, we tested models that included interactions between age and price, income and price, and both. Generally speaking, older groups of consumers exhibited greater price sensitivity. Using 18-24 year olds as the reference group:

the 25-34 year old group did not have significantly different price sensitivity, but older age groups, particularly over the age of 45, were significantly more price sensitive. In terms of income, those in lower incomes exhibited greater price sensitivity.

Table A4: Segment analysis of preference including interactions between price and age and income groups

	Variable	Main model with age:price interaction	Main model with income:price interaction	Main model with age*price and income:price interaction
Preference coefficients	Monthly subscription price	-1.018*** (0.042)	-1.091*** (0.030)	-0.834*** (0.049)
	Optout ASC	-10.895*** (0.528)	-9.932*** (0.480)	-10.183*** (0.494)
	Automatic loyalty points feature: ON	0.642*** (0.032)	0.628*** (0.033)	0.679*** (0.033)
	Receipt storage feature: ON	0.576*** (0.030)	0.572*** (0.030)	0.610*** (0.031)
	ID storage feature: ON	0.449*** (0.031)	0.429*** (0.031)	0.500*** (0.031)
	Flexible card feature: ON	0.420*** (0.033)	0.401*** (0.033)	0.458*** (0.033)
	Price:age 18-24	<i>omitted</i>	-	<i>omitted</i>
	Price:age 25-34	0.035 (0.051)		-0.028 (0.054)
	Price:age 35-44	-0.125* (0.055)		-0.168** (0.056)
	Price:age 45-54	-1.110*** (0.066)		-1.237*** (0.070)
	Price:age 55-64	-1.824*** (0.084)		-1.839*** (0.088)
	Price: age 65+	-1.864*** (0.084)		-1.769*** (0.087)
	Price:income >£48k	-	<i>omitted</i>	<i>omitted</i>
	Price:income >£28k to £48k		-0.383*** (0.043)	0.185*** (0.045)
	Price:income up to £28k		-0.565*** (0.046)	0.256*** (0.049)
Model fit	Log-likelihood	-13253	-12603	-12340

Models including demographic factors (age and income) interacted with price

*Notes: Mixed logit model with normally distributed random coefficients for the four premium wallet features and opt-out ASC. Price treated as a fixed coefficient. * = $p < .05$, ** = $p < .01$, *** $p < .001$. Standard errors for the coefficient estimates are in brackets. Willingness-to-pay estimates are derived from the ratio of the feature and price coefficients.*