Appendix I

Beginning with the logit model with the scale parameter (σ) of the error term (ε) made explicit and being respondent-specific, we get:

$$\widetilde{U}_{nj} = \beta_n' x_{nj} + \varepsilon_{nj} \;/\; \sigma_n$$

where $\varepsilon_{nj} \;/\; \sigma_n$ has the variance of $\Pi^2 \;/\; 6\sigma_n^2$. Modifying the above expression by multiplying both sides by σ_n, the following equivalent formulation is obtained, that is known as the GMNL-II specification by Fiebig et al. (2010):

$$U_{nj} = (\sigma_n \beta_n')x_{nj} + \varepsilon_{nj}$$

As β and σ cannot be identified separately , Fiebig et al. (2010) recommend the following specification of the scale parameter: $\sigma_n = \exp\,(\overline{\sigma} + \theta' z_n + \tau\varepsilon_{0n})$, where $\varepsilon_{0n} \sim N(0,1)$ and z_n is a vector of individual characteristics, with $\overline{\sigma} = \frac{-\tau^2}{2}/2$ so that $E(\sigma_n) = 1$, when $\theta = 0$. The GMNL model reduces to the RPL specification if $\tau = \theta = 0$, as τ represents a measure of scale heterogeneity.

The GMNL model can be reparametrized to estimate taste parameters in WTP space (Greene and Hensher 2010). First, separating the cost variable (p) and its coefficient ($\beta_{p,n}$), we obtain:

$$U_{nj} = \sigma_n(\beta_{p,n}p + \beta_n' x_{nj}) + \varepsilon_{nj} = \sigma_n \beta_{p,n}(-p + (\beta_n'/\beta_{p,n})x_{nj}) + \varepsilon_{nj}$$

Normalizing the cost coefficient ($\beta_{p,n}$) of -p to 1 yields the subsequent WTP space specification, where $\beta_n'^{*}$ gives the individual-specific WTP estimates directly.

$$U_{nj} = \sigma_n(-p + \beta_n'^{*} x_{nj}) + \varepsilon_{nj}$$

This formulation bypasses the need to specify the distribution of the ratio of two random coefficients. Fiebig et al. (2010) highlight that the model performs relatively poorly if the alternative-specific constant is scaled, because it is fundamentally different from observed attributes. Hence, in the subsequent specification, vector *x* includes only observed attributes of the alternative from Table 1, which are absent when the opt-out option is chosen.

$$U_{nj} = \beta_n \sigma_n(-p + \beta_n'^{*} x_{nj}) + \varepsilon_{nj}$$

In the final equation, the coefficient β_n is split into three parts: the component $\beta_{0,j}$, which is constant across respondents – i.e. the mean coefficient for the base demographic segment; γ_j in order to account for observed heterogeneity in the mean coefficient regarding preferences for river restoration measures in general – captured by demographic variables (*z*); and the individual-specific deviation $\eta_{0,n,j}$. The same specification applies to the WTP coefficients ($\beta_n'^{*}$), where μ_j is the vector of the demographic effects that influence the mean of WTP.

$$U_{nj} = (\beta_{0,j} + \gamma_n'^{*} z_n + \eta_{0,n,j}) + \sigma_n\left[-p + (\beta_j'^{*} + \mu_j'^{*} z_n + \eta_{n,j}'^{*})x_{nj}\right] + \varepsilon_{nj}$$

We presume that the vector ($\beta_{,n}$, $\beta_j'^{*}$) has a normal distribution with correlated coefficients. This is appropriate, as there are no clear expectations on the signs of these coefficients. Allowing for correlations can deliver more insights on the structure of preferences for different attributes. This final GMNL specification can be estimated via simulated maximum likelihood methods.