A.2.3 Frequency weighting in ADMB-RE

Model description Let X_i be binomially distributed with paramters $N = 2$ and p_i, and assume that

$$p_i = \frac{\exp(\mu + u_i)}{1 + \exp(\mu + u_i)}, \tag{A.3}$$

where μ is a parameter and $u_i \sim N(0, \sigma^2)$ is a random effect. Assuming independe, the loglikelihood function for the parameter $\theta = (\mu, \sigma)$ can be written:

$$l(\theta) = \sum_{i=1}^{n} \log\left[p(x_i; \theta)\right]. \tag{A.4}$$

In ADMB-RE $p(x_i; \theta)$ is approximated using the Laplace approximation. However, since x_i only can take the values 0, 1 and 2, we can re-write the loglikelihood as

$$l(\theta) = \sum_{j=0}^{2} n_j \log\left[p(j; \theta)\right], \tag{A.5}$$

where n_j is the number x_i being equal to j. Still the Laplace approximation must be used to approximate $p(j; \theta)$, but now only for $j = 0, 1, 2$, as opposed to n times above. For large n this can give large savings.

To implement the loglikelihood (A.5) in ADMB-RE you must organize your code into a SEPARABLE_FUNCTION (see the section "Nested models" in the ADMB-RE manual). Then you should do the following

- Formulate the objective function in the weighted form (A.5).
- Include the statement `!! set_multinomial_weights(w)` in the PARAMTER_SECTION, where `w` is a vector (with indexes starting at 1) containg the weights, so in our case $w = (n_0, n_1, n_2)$.

Files http://otter-rsch.com/admbre/examples/weights/weights.html

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