BAYESIAN MULTILEVEL MODELS

4.4 EXTENSIONS TO MODELS WITH NON-GAUSSIAN PRIORS

One of the main advantages of taking a Bayesian approach to multilevel modeling is the flexibility in defining extended model types and classes by adding additional layers to the hierarchical prior structure. In the following, we will briefly discuss some of these extended models with non-Gaussian priors arising either by adding suitable hyperpriors to the variance parameters, leading to scale mixture of normal priors, or by replacing the usual, parametric iid prior with mixture distributions of different type. When using suitable prior choices involving conjugate priors, it is often possible to retain Gibbs sampling steps at several places in the MCMC algorithms. In addition, due to the modularity of MCMC

Figure 4.4 Estimated Price Effects in the Model (4.13). Shown are the posterior mean together with 80% and 95% pointwise credible intervals

Figure 4.5 Log-Sales Versus Log-Price Curves in Model (4.13) for Four Different Outlets together with Corresponding Partial Residuals

where

• \( f_1 \) is an unknown smooth nonlinear decreasing function of the brand’s own price, and \( f_2, \ldots, f_4 \) are unknown smooth nonlinear increasing functions of prices of competing brands;

• \( u_{i0} \) is a random store effect accounting for heterogeneity in baseline sales across stores; and

• \( u_{i1} + 1, \ldots, u_{i4} + 1 \) are store-specific scaling factors accommodating heterogeneity of the non-parametric own- and cross-item price effects across stores (while the overall functional forms remain constant from store to store).

More details on the approach and results are given in Lang et al. (2011a); see also Lang et al. (2011b).