A default Bayesian approach for regression on extremes

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1 Electronic Appendix

The values of coefficients used in the simulation study are

$$\begin{aligned}\boldsymbol{\beta} &= (1,0,1,1)\\ \boldsymbol{\gamma} &= (0,0.5,-0.3,0.3)\\ \boldsymbol{\alpha} &= (1.55,0.7,-0.2,1.2).\end{aligned}$$

Perturbation terms ϵ_{ξ_i}, ϵ_{ν_i} and $\epsilon_{\lambda_i^*}$ are generated, independently, from a $N(0,\sigma_\epsilon)$. They are added to the linear predictor

$$\begin{aligned}\xi_i &= \exp(\boldsymbol{x}_i^T\boldsymbol{\gamma}+\epsilon_{\xi_i})-1\\ \nu_i &= \exp(\boldsymbol{x}_i^T\boldsymbol{\beta}+\epsilon_{\nu_i})\\ \lambda_i^* &= (\boldsymbol{x}_i^{*T}\boldsymbol{\alpha}+\epsilon_{\lambda_i^*})^2,\end{aligned}$$

but they act exponentially and quadratically into the parameters of the Poisson-GPD model. Therefore, based on the values of regression coefficients, we fixed σ_ϵ to 0.1 and 0.5. In order to appreciate the amount of noise induced by these values of σ_ϵ, Figure 1 shows the true values of ξ_i, ν_i and λ_i^* along with a sample of perturbed values. When $\sigma_\epsilon = 0.5$ we can see, from Figure 1, that the true values of ξ_i, ν_i and λ_i^* can be very different from the perturbed ones. Therefore, for $\boldsymbol{\beta}$, $\boldsymbol{\gamma}$ and $\boldsymbol{\alpha}$ fixed in the simulation scenario, values of σ_ϵ larger than 0.5 are meaningless.

Figures 2 and 3 shows results for $\sigma_\epsilon = 0.1$, while Figures 4 and 5 for $\sigma_\epsilon = 0.5$. We can see that an increase of the noise, in the linear predictors, determines a degrading of posterior inference for a fixed n. Such degrading is attenuated by an increase of n or a larger observation period. However, while this is generally true for most of the coefficients, it is not true for the intercepts β_1, γ_1 and α_1. This effect is well known in the classical regression analysis.

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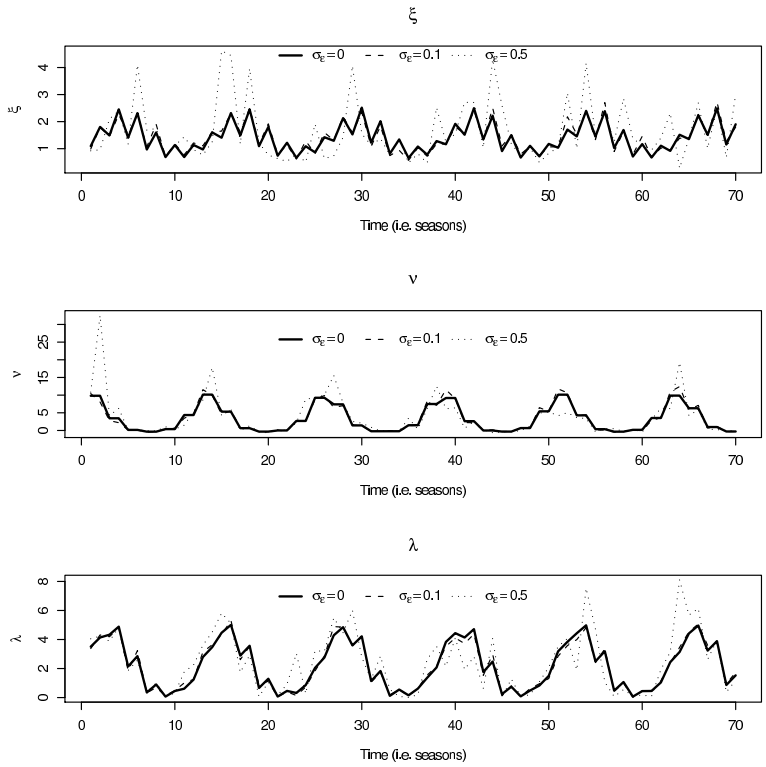

Figure 1: *Values of ξ, ν and λ^* varying with covariates along time. The true values are in bold and we can see a sample of the noised generated values.*

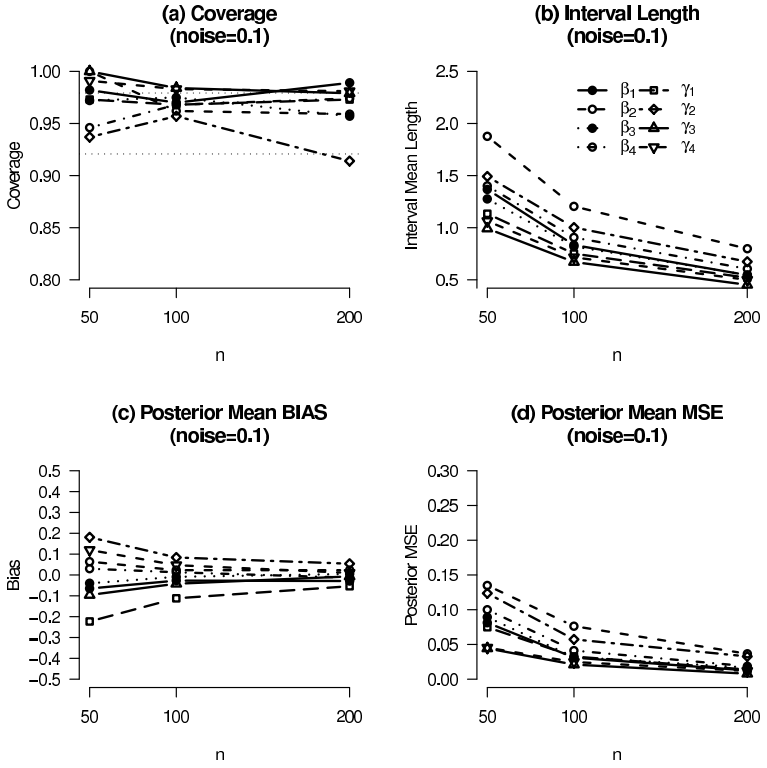

Figure 2: *Properties of posterior distribution for regression parameters of* ξ *and* ν *when the noise is* $\sigma_\epsilon = 0.1$.

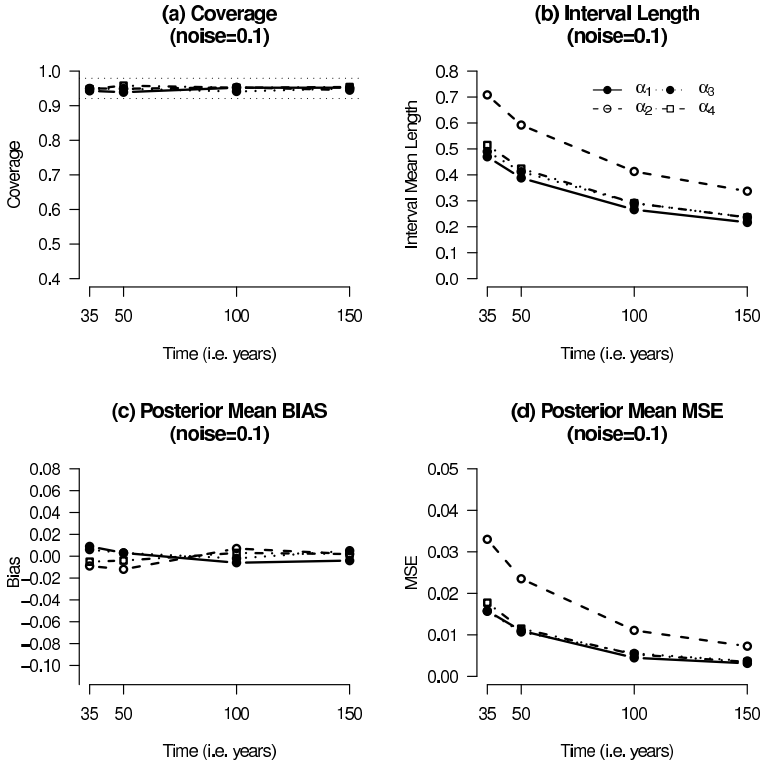

Figure 3: *Properties of posterior distribution for regression parameters of λ^* when the noise is $\sigma_\epsilon = 0.1$.*

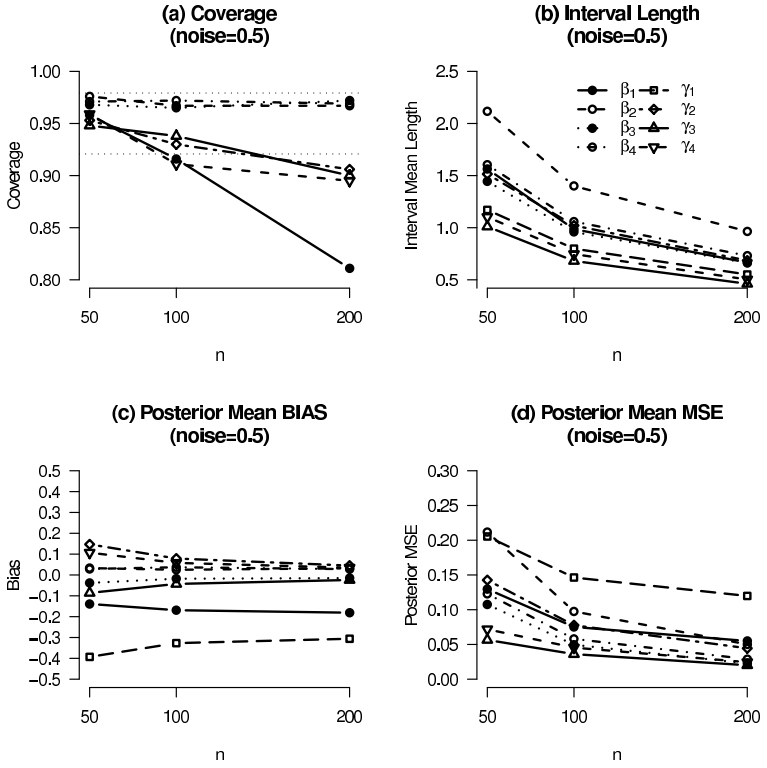

Figure 4: *Properties of posterior distribution for regression parameters of* ξ *and* ν *when the noise is* $\sigma_\epsilon = 0.5$.

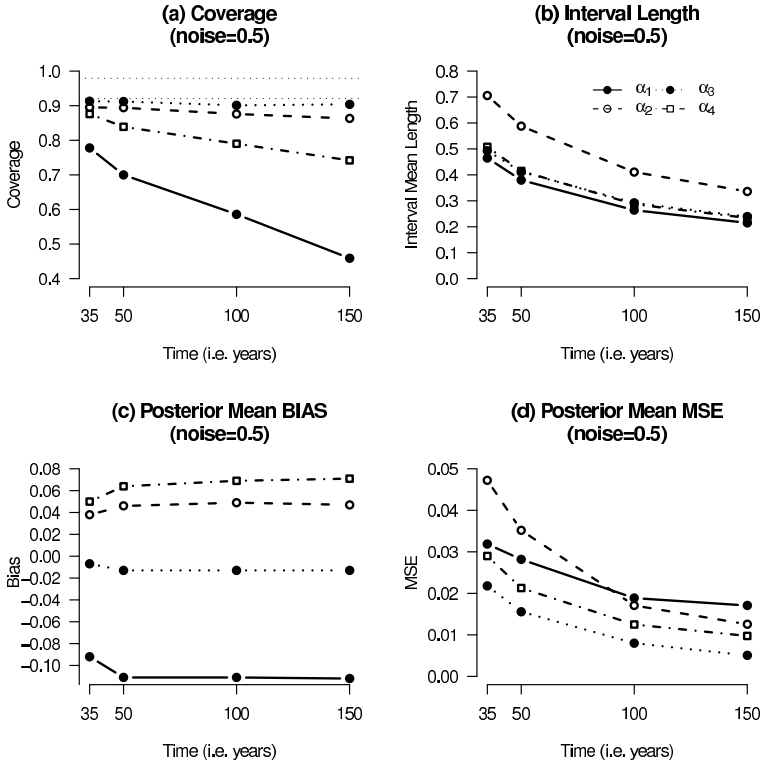

Figure 5: *Properties of posterior distribution for regression parameters of* λ^* *when the noise is* $\sigma_\epsilon = 0.5$.