## Asymptotic distributions of some scale estimators in nonlinear models with long memory errors having infinite variance

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Abstract. To have scale invariant M estimators of regression parameters in regression models there is a need for having a robust scale invariant estimator of a scale parameter. The two such estimators are the median of the absolute residuals  $s_1$  and the median of the absolute differences of pairwise residuals,  $s_2$ . The asymptotic distributions of these estimators in regression models when errors have finite variances are known in the case errors are either i.i.d. or form a long memory stationary process. Since M estimators are robust against heavy tail error distributions, it is natural to know if these scale estimators are consistent under heavy tail error distribution assumptions. This paper derives their limiting distributions when errors form a linear long memory stationary process with  $\alpha$ stable  $(1 < \alpha < 2)$  innovations and moving average coefficients decaying as  $j^{d-1}, 0 < d <$  $1 - 1/\alpha$ . We prove that  $s_2$  has an  $\alpha_*$ -stable limit distribution with  $\alpha_* = \alpha(1 - d) < \alpha$ while the convergence rate of  $s_1$  is generally worse than that of  $s_2$ . The proof is based on the 2nd order asymptotic expansion of the empirical process of the stated infinite variance stationary sequence derived in this paper.