Records for weights of Hereford and Polled Hereford cattle from birth to 820 days of age were analysed fitting a random regression model involving cubic, orthogonal polynomials for direct and maternal effects, both genetic and permanent environmental, and heterogeneous error variances. Data comprised 367,942 records on 130,412 animals in 90 herds, with 176,718 animals in the analysis in total. Estimates of 60 (co)variance components were obtained using Gibbs sampling. Up to 700 days of age, results agreed well with univariate and literature values, but some estimates for the highest ages with least records were implausible. Heritabilities declined sharply after birth until about 100 days. Variances due to maternal effects showed a distinct peak between 160 and 200 days of age. Results show that covariances between weights of beef cattle for a considerable range of ages can be modelled adequately through random regressions.