

# DESIGN AND ANALYSIS OF A NEW BOUNDED LOG-LINEAR REGRESSION MODEL

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## ABSTRACT

This dissertation introduces a new regression model in which the response variable is bounded by two unknown parameters. A special case is a bounded alternative to the four parameter logistic model which is also called the  $E_{\max}$  model.

The likelihood function for the new model is unbounded, and the global maximizers are not consistent estimators of unknown parameters. To obtain efficient estimation, we suggest using the local maximizers of the likelihood function. We prove that, with probability approaching one as the sample size goes to infinity, there exists a solution to the likelihood equation that is consistent at the rate of the square root of the sample size and it is asymptotically normally distributed. The technique we used applies to the consistency of local maximum likelihood estimator for the well known three parameter log-normal distribution, for which a rigorous proof has been missing for a long time.

Optimal experimental designs for a case of the new regression model is then addressed. We show that the D-optimal designs are independent of the two parameters representing the boundaries of the responses, but they depend on the variance of the error. Theoretically, we obtain that any design satisfying classical optimality criteria based on the information matrix consists at most five points including the two endpoints of the design space. Furthermore, if the error variance is known and big, we prove that the D-optimal design is a two points design with equal weights on the two boundaries.