A BAYESIAN APPROACH TO PARAMETER ESTIMATION IN BINARY LOGIT AND PROBIT MODELS

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Abstract
In the areas of statistics and econometrics the analysis of binary and polychotomous response data is widely used. In classical statistics, the maximum likelihood method is used to model this data and inferences about the model are based on the associated asymptotic theory. However, the inferences based on the classical approach are not accurate if the sample size is small. J.H. Albert and S. Chib (Bayesian Analysis of Binary and Polychotomous Response Data, J. American Statistical Association 422, 669–679, 1993) proposed a Bayesian method to model categorical response data. In this method Gibbs sampling and the data augmentation algorithm are used together to model the data. In this article, Albert and Chib’s approach is used to estimate the parameters in the logit and probit models. Furthermore, the maximum likelihood and ordinary least-squares methods are discussed briefly, and a simple example is presented to compare these three methods.

Keywords: Binary probit model, Binary logit model, Bayesian analysis, Albert and Chib approach, Latent data, Gibbs sampling, Data augmentation.

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1. Introduction
If the dependent variable in a data set is categorical, Generalized Linear Models (GLMs) are used instead of linear regression models to estimate the model parameters and to model the data. GLMs can be expressed in the form $E(y) = g(x'\beta)$, where $y$ is a response variable which is categorical, $x$ is the vector of explanatory variables, $\beta$ is the vector of model parameters and $g$ is the link function. GLMs depend on a probability model that describes an event’s probability as the distribution function of the independent variables. The model is binary if the dependent variable takes two