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A parametric quantile beta regression for modeling case fatality rates of COVID-19

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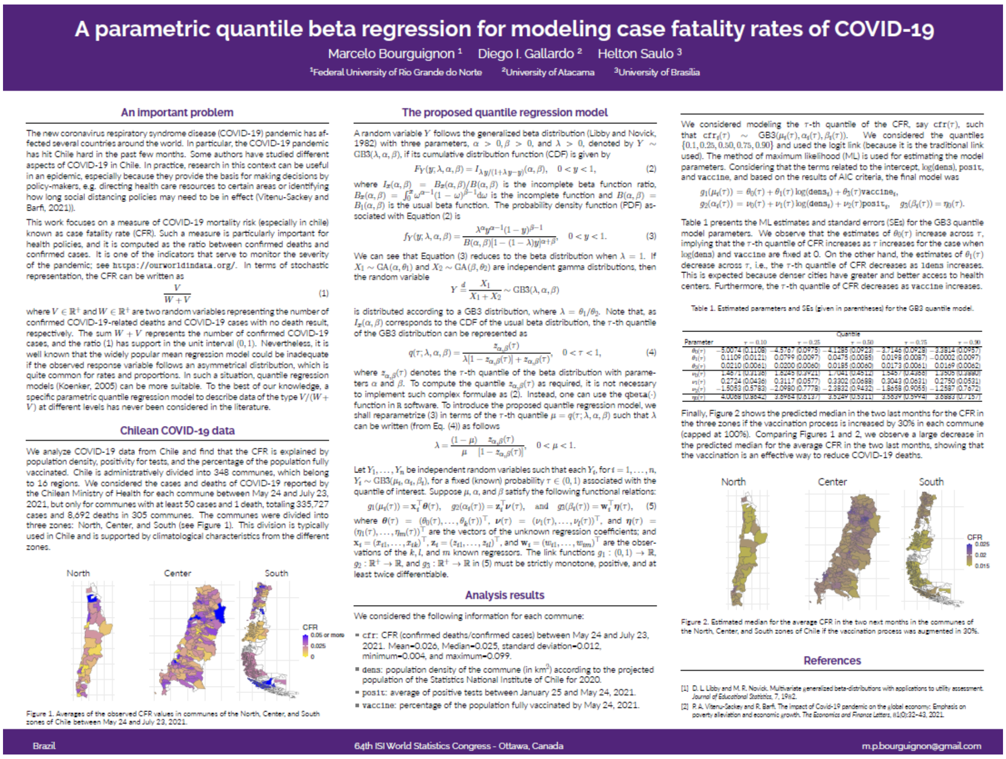

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Brief Description

Motivated by the case fatality rate of COVID-19, we develop a fully parametric quantile regression model based on the generalized three-parameter beta (GB3) distribution.

We first reparameterize the GB3 distribution by inserting a quantile parameter and then we develop the new proposed quantile model.

We also propose a simple interpretation of the predictor-response relationship in terms of percentage increases/decreases of the quantile.

A real COVID-19 dataset from Chile is analyzed and discussed to illustrate the proposed approach.

Abstract

Motivated by the case fatality rate (CFR) of COVID-19, in this paper, we develop a fully parametric quantile regression model based on the generalized three-parameter beta (GB3) distribution. Beta regression models are primarily used to model rates and proportions. However, these models are usually specified in terms of a conditional mean. Therefore, they may be inadequate if the observed response variable follows an asymmetrical distribution, such as CFR data. In addition, beta regression models do not consider the effect of the covariates across the spectrum of the dependent variable, which is possible through the conditional quantile approach. In order to introduce the proposed GB3 regression model, we first reparameterize the GB3 distribution by inserting a quantile parameter and then we develop the new proposed quantile model. We also propose a simple interpretation of the predictor-response relationship in terms of percentage increases/decreases of the quantile. A Monte Carlo study is carried out for evaluating the performance of the maximum likelihood estimates and the choice of the link functions. Finally, a real COVID-19 dataset from Chile is analyzed and discussed to illustrate the proposed approach.