# ASYMPTOTIC DISTRIBUTION FOR CONDITIONAL MODE ESTIMATOR VIA SMOOTHED QUANTILE REGRESSION

20° TIME SERIES AND ECONOMETRICS MEETING

July - August, 2023, Florianópolis, Brazil

**Eduardo Schirmer Finn**[*†] (eduardosfinn@outlook.com)

**Eduardo de Oliveira Horta**[*] (eduardo.horta@ufrgs.br)

**ABSTRACT**

Since the canonical paper of Koenker and Barrett (1978)[2] Quantile Regression has become a widely used tool in econometrics and statistics, due to its appealing features, such as robustness to outlier contamination, asymmetric distribution and non-Gaussian errors. Still in the setting of highly skewed or fat-tailed distributions, the mode - in particular the conditional mode - has emerged as an useful criterion in circumstances that mean or median-focused methods cannot capture the central tendencies of the data. Therefore, Ota, Kato and Hara (2019)[1] proposed a way to estimate the conditional mode of some variable given its covariates through a computationally scalable estimator derived from the traditional quantile regression model, that asymptotically follows a Chernoff distribution. Consequently, in a recent effort, Ongaratto and Horta (2021)[4] proposed a estimator for the conditional mode via a smoothed quantile regression function based on Fernandes, Guerre and Horta's (2021)[3] estimator; since the smoothed estimator is asymptotically differentiable it bears computational efficiency and circumvents the curse of dimensionality. The present work develops the asymptotic theory for the Ongaratto and Horta (2021) estimator, since grounded on Monte Carlo simulatios it outpaced Ota, Kato and Hara's (2019)[1] approach.

**KEYWORDS:** Quantile Regression; Conditional Mode; Asymptotic Theory.

## References

[1] Kengo Kato Hirofumi Ota and Satoshi Hara. Quantile regression approach to conditional mode estimation. *Electronic Journal of Statistics*, 13(2):3120–3160, 2019.

[2] Roger Koenker and Gilbert Bassett. Regression quantiles. *Econometrica*, 46(1):33–50, 1978.

[3] Emmanuel Guerre Marcelo Fernandes and Eduardo Horta. Smoothing quantile regressions. *Journal of Business & Economic Statistics*, 39(1):338 – 357, 2021.

[4] Artur Ongaratto and Eduardo Horta. Conditional mode: An approach via smoothed quantile regression. 2021.

[*]Department of Statistics, Universidade Federal do Rio Grande do Sul (UFRGS), Av. Bento Gonçalves, 9500, Porto Alegre, RS, 91509-900, Brazil.

[†]Corresponding author.