The objective of this research is to study the effect of unit root test on predictor of the Gaussian AR(p) process. We propose the predictor following unit root test and found that this predictor outperforms the standard predictor when the autoregressive parameter approaches unit root. The second topic deals with the effect of unit root tests on prediction interval of the Gaussian AR(p) process. We propose the new prediction interval following unit root test and found that this prediction interval outperforms the standard prediction interval as their expected length is shorter than the standard prediction interval when the autoregressive parameter approaches unit root.

**INTRODUCTION**

Suppose $Y_t - \mu = \phi_1(Y_{t-1} - \mu) + \phi_2(Y_{t-2} - \mu) + \ldots + \phi_p(Y_{t-p} - \mu) + \epsilon_t$, (1) is a Gaussian AR(p) process where $\mu$ is the population mean, $\phi_1, \ldots, \phi_p$ are the autoregressive parameters and $\epsilon_t$ are unobservable independent errors having zero mean and finite variance, $E(\epsilon_t) = 0$, $V(\epsilon_t) = \sigma^2$. If the hypothesis is accepted, the prediction interval of (1) is:

$$PI_\alpha = \left[ \hat{Y}_{p+1} + a_{1\alpha} \hat{\alpha}_1 + \ldots + a_{p\alpha} \hat{\alpha}_p, \hat{Y}_{p+1} + a_{1\alpha} \hat{\alpha}_1 + \ldots + a_{p\alpha} \hat{\alpha}_p \right]$$

If the hypothesis is rejected, the prediction interval of (1) is:

$$PI_\alpha = \left[ \hat{Y}_{p+1} + a_{1\alpha} \hat{\alpha}_1 + \ldots + a_{p\alpha} \hat{\alpha}_p, \hat{Y}_{p+1} + a_{1\alpha} \hat{\alpha}_1 + \ldots + a_{p\alpha} \hat{\alpha}_p \right]$$

**PREDICTOR AND PREDICTION INTERVAL**

**MOTIVATION WITH AR(1)**

**UNIT ROOT TESTS AS PRELIMINARY TESTS**

$$t = (\hat{\alpha}_1)/SE(\hat{\alpha}_1)$$

where SE($\hat{\alpha}_1$) is the estimated standard error of $\hat{\alpha}_1$. The quantities of test statistic $t$, estimated by simulation, for $H_0 : \alpha_1 = 0$ are provided in Table B7 of [2].

If the hypothesis is accepted, predictor of (1) is:

$$\hat{\phi}_1 = \hat{\phi}_1 + \hat{\phi}_2 \hat{Y}_t + \ldots + \hat{\phi}_p \hat{Y}_{t-p+2}$$

If the hypothesis is rejected, the predictor of (1) is:

$$\hat{\phi}_1 + (\hat{\phi}_1 + 1) \hat{Y}_t + \hat{\phi}_2 \hat{Y}_t + \ldots + \hat{\phi}_p \hat{Y}_{t-p+2}$$

**Conclusions**

We proved 3 theorems and published 2 papers. Our proposed predictor and prediction interval following the results of unit root test outperform the standard predictor and the standard prediction interval.

**Publications**


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