



Bayesian Approach to Unit Root Testing in AR(1) Time Series

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For this project I compared the Bayesian and Frequentist approaches to unit root testing. An AR(1) Times Series is where each $y(t) \in \{y(1), y(2), \dots, Y(T)\}$ can be modelled as:

$$y(t) = \rho y(t-1) + \varepsilon(t)$$

with $\varepsilon(t)$ identically and independently distributed $\sim N(0, \sigma)$

We want to know if $\rho = 1$, then our data is a random walk, or if $\rho \in (-1, 1)$, then our data is a Stationary Time Series.

Traditionally the Frequentist approach is to use the Dickey-Fuller Test. This test sets the null hypothesis as $\rho = 1$ which leads to a bias of finding that a data set is a random walk. As explained in "*A Bayesian analysis of the unit root in real exchange rates*" (1991) *Journal of Econometrics* by P.Schotman and H.K. van Dijk, Bayesian Statistics has a more symmetrical approach to Inference. This allows us to get odds of a random walk as well as a posterior distribution which give us a pdf of ρ .

I worked through *P.Schotman and H.K. van Dijk* to prove I understood how and why they took the steps and arrived at the conclusions they did. I also wrote functions and ran simulations in R Statistical Package.

This project was fascinating and gave me a wonderful understanding of how a published paper was produced. I learnt a lot more about Bayesian Statistics and Time Series Modelling that I did during my undergraduate as well as using R and latex software packages. I was very lucky to have Associate Professor Paul Kabaila as my supervisor as he has done extensive work in both Frequentist and Bayesian Statistics and has an infectious passion for Statistics.

The Big Day In was also a great experience to meet many other young mathematicians and here of the work they did for their projects as well as what they want to do for future studies. The conference was really well run and entertaining. The only downside was flying in on the first morning, rather than the night before.