

ANALYSIS OF INTEGRATED AND COINTEGRATED TIME SERIES WITH R

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Integration and cointegration of time series have become an essential part of the modern Econometry. This book presents a good overview on those topics. As the author points out: “although the book’s content is not a pure theoretical exposition of integration analysis, it is particularly suited as an accompanying text in applied computer laboratory classes”. It combines theoretical concepts with applied examples coded in R, allowing the reader not only to grasp the concepts but also to apply them to real cases. At the end of each chapter there is a Summary, emphasizing the most important ideas exposed in the chapter. Additionally, a set of exercises is proposed with the idea that the readers apply, by means of R contributed packages, the notions covered in the chapter. All tests and models used in this book are included in the “*urca*” package. Bernhad Pfaff is the author and maintainer of the CRAN contributed packages “*urca*” and “*vars*”.

This book is appropriate for graduate students and professionals in applied econometrics and also is suitable as a support for the computer sessions lab.

The book is divided into 9 chapters and organized into three parts:

- Theoretical Concepts
- Unit Root Tests
- Cointegration

Chapters 1-3 comprise the first part. This first part is a review of the basic ideas of time series models, unit roots and cointegration. Chapter 1 gives the background to ARMA models, introducing the notation that will be used around the book. Chapter 2 reviews the key concepts of nonstationary time series models such that integrated, seasonally integrated and fractionally integrated univariate time series models. Finally, Chapter 3 is focused on multivariate relationships between time series. Spurious regression is presented before discussing the concept of Cointegration and Error-Correction models, finalizing this Chapter with vector correction models (VECM). At this point the author discusses the decomposition of a time series models into deterministic and stochastic component and the extension of this decomposition to the multivariate case, before

presenting VECM models. The concepts presented in Chapters 2 and 3 will be discussed in more depth in parts 2 and 3 of the book.

Part 2 is dedicated to Unit Root Test and includes Chapter 4 and 5. Chapter 4 introduces the most used test in econometrics, the Dickey-Fuller test and its extensions (ADF test). Next, the author proposes a sequential test strategy with the aim of deciding whether to fit a trend to the data or to difference the process in order to work with an integrated process. Next, the following unit root tests used in the time series area, are introduced: Philips-Perron Test (P-P Test), ERS Test, Schmidt-Phillips (SP)-Test and KPSS-Test, emphasizing the form of the null hypothesis for each test. With the purpose of showing the pros and cons of those tests, the author applies those tests to two time series: Consumption in United Kingdom and the nominal GNP in the United States. This practical way of introducing those tests makes clear the advantages and disadvantages of them. Structural breaks in time series and the Zivot-Andrews test to detect them are considered in Chapter 5, showing how a structural break can modify the order of integration of a process. In this chapter seasonal unit roots are also introduced.

Finally, part 3 concentrates on the cointegration methodology, starting with the case of single equation models in Chapter 6, and ending up with more sophisticated vector error correction model (VECM) in Chapter 7. This part will be particularly helpful to beginners to better understand the difficult concept of cointegration. Chapter 6 introduces the reader to this topic with the intuitive Engel-Granger Two Step Procedure and Chapter 7 deals with the VECM model, particularly useful for a better comprehension of the nature of nonstationarity among several time series. The detection of cointegration rank is tested following the Johansen and Juselius approach. The data used in this chapter is the same data used in Johansen and Juselius paper (Oxford Bulletin of Economics and Statistics, 52, 2, 1990), making it easy to follow the results published in the mentioned paper. Finally, this Chapter presents the detection of structural breaks in a VAR model and how they affect VECM models.

The book concludes with a very useful appendix about time series data, tools and contributed packages stored in CRAN.

Hence, I recommend this book as a companion text in lab sessions to better understand the concepts of Integrated and Cointegrated Time Series.

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