ON EMPIRICAL MULTIPLE
TIME SERIES ANALYSIS

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1. Introduction

Like probability theory, modern time series analysis has the feature that many of its most elementary theorems are based on rather deep mathematics, while many of its most advanced theorems are known and understood by research workers who do not have the mathematical background to understand the proofs. It is natural to think of the theory of time series analysis as composed of two parts, *foundations* (a probabilistic part involving deep mathematics and based on the unrealistic assumption that one knows the probability law of the time series) and *empirical* (in which one considers statistical and computational procedures). While the probabilistic theory of time series can be pursued for the sake of its great beauty, it would be a mistake if the statistical theory were to be developed only for its elegance. The ultimate aim of the statistical theory of time series analysis must be to provide *data-handling procedures* for achieving the aim of time series analysis, *synthesis of stochastic models* which can be used to describe and perhaps to control the mechanisms generating each time series and relating various time series. For this reason, one may define a field which may be called "empirical time series analysis" with aims such as the following:

(1) to develop the statistical theory in such a way that it provides a philosophy for judging and interpreting the statistical data reduction which can be provided by computers;

(2) to develop efficient computer programs for the statistical analysis of empirical time series;

(3) to obtain experience in the small sample applicability and robustness of statistical procedures derived from asymptotic theory;

(4) to focus attention on theoretical questions requiring further investigation.

One of my concerns in recent years has been to develop a computer program for empirical time series analysis. There were several reasons motivating this concern:

(1) I discovered that when a researcher came to me for advice on time series analysis, I could do him the most good by (in addition to telling him which formulas to use) making available to him a computer program for carrying out the analysis.