

Applied Time Series Econometrics with Gretl

A Practical Guide Using Price Transmission
Applications

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Applied Time Series Econometrics with Gretl: A Practical Guide Using Price
Transmission Applications

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DEDICATION

To my twin daughters, Aphrodite and Penelope, and to my son, Nikos.

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PREFACE

Economic relationships unfold over time. Prices, production, consumption, interest rates, exchange rates, and many other economic variables are influenced not only by current conditions but also by their own past values and by the past behavior of other variables. Understanding these dynamic relationships is therefore essential for empirical economic analysis.

This book was written to provide a practical introduction to applied time series econometrics using Gretl, an open-source econometric software package that combines a user-friendly graphical interface with a wide range of tools for statistical and econometric analysis. The main objective is to help readers understand the fundamental principles of time series econometrics and, at the same time, develop the practical skills required to estimate, interpret, evaluate, and compare dynamic econometric models.

A central feature of the book is the use of price transmission analysis as a continuous empirical application. Price transmission provides a particularly useful framework for learning time series econometrics because it incorporates many of the main issues encountered in empirical analysis, including lagged responses, short-run dynamics, non-stationarity, cointegration, long-run equilibrium relationships, error correction mechanisms, asymmetry, and interactions among multiple endogenous variables.

The empirical applications focus primarily on the relationship between producer and retail prices in agri-food markets. In particular, the same dataset on producer and retail potato prices is used throughout the book. The use of a common dataset allows readers to observe how alternative econometric methods approach the same economic relationship and to compare their assumptions, estimation procedures, results, and interpretations.

Although the applications are drawn from agri-food markets, the econometric methods presented are general. They can be applied to a wide range of economic and business problems involving variables observed over time, including applications in macroeconomics, finance, energy economics, environmental economics, industrial organization, marketing, international economics, commodity markets, housing markets, and other fields of applied research.

The book follows a progressive structure. It begins with the basic concepts required for understanding time series data and then moves gradually toward

more advanced dynamic models. The early chapters introduce time series concepts, stationarity, unit roots, distributed lag models, and dynamic regression models. The analysis then proceeds to cointegration and Error Correction Models, which provide a framework for jointly analyzing short-run adjustment and long-run equilibrium relationships.

The final chapters present Vector Autoregressive Models and Vector Error Correction Models, together with Granger causality tests, Impulse Response Functions, Forecast Error Variance Decomposition, Johansen cointegration analysis, and the principal diagnostic tests required for evaluating the adequacy of the estimated models.

Each chapter follows a common pedagogical structure. The econometric method is first introduced theoretically and, where appropriate, expressed mathematically. The estimation procedure is then demonstrated step by step in Gretl. Screenshots, model outputs, tables, and graphs are used to show the complete empirical process. Particular emphasis is placed on the interpretation of the results, since the objective is not merely to produce econometric output but to understand its statistical and economic meaning.

The book is intended for undergraduate and postgraduate students, doctoral researchers, applied economists, practitioners, and other readers who wish to develop a practical understanding of time series econometrics. A basic knowledge of regression analysis is useful, but no previous experience with Gretl is required. The material is designed to be accessible to readers who prefer menu-based software implementation, while also providing the conceptual foundations needed for more advanced empirical work.

Gretl was selected because it is free, open-source, widely accessible, and particularly suitable for teaching and self-study. Its graphical interface allows users to implement sophisticated time series techniques without extensive programming experience. At the same time, its scripting capabilities make it suitable for reproducible research and more advanced applications. Although the empirical analyses in this book are conducted in Gretl, the underlying econometric principles are software-independent and can also be implemented in R, Stata, EViews, Python, SAS, and other statistical packages.

This volume concentrates on the fundamental methods of applied time series econometrics. More advanced approaches, including ARDL, NARDL, quantile models, Bayesian methods, threshold models, volatility models, and machine-learning techniques, are reserved for subsequent volumes in the series. This separation allows the present book to maintain a clear and coherent focus while providing the essential foundation required for more advanced study.

The book has been shaped by many years of teaching, research, and empirical work in applied economics and price transmission analysis. Its purpose is to bridge the gap between econometric theory and practical implementation and to help readers move from understanding a model conceptually to estimating it correctly and interpreting its results confidently.

I hope that the book will serve both as a practical textbook for university courses and as a useful reference for researchers and practitioners conducting empirical time series analysis.

Anthony N. Rezitis

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1 INTRODUCTION TO APPLIED TIME SERIES ECONOMETRICS

1.1 Introduction

Applied time series econometrics is a central branch of empirical economics. It provides the statistical and econometric tools required to analyze dynamic relationships among economic variables observed over time. These methods are widely applied in macroeconomics, finance, agricultural economics, energy economics, environmental economics, industrial organization, marketing, and many other fields in which understanding the evolution of economic variables is of fundamental importance.

One of the most important applications of time series econometrics is price transmission analysis, which examines how price changes occurring at one stage of a market or supply chain are transmitted to other stages over time. In many markets, prices are determined sequentially along the supply chain. A change in price at one stage, for example at the producer level, is expected to influence prices at subsequent stages. The central questions are whether this price change is transmitted fully or partially, immediately or with a delay, and symmetrically or asymmetrically.