

# ARCH/GARCH Models in Applied Financial Econometrics

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Research supported by National Science Foundation Grant IRI-0312285 and the University of California, San Diego

Abstract: This paper surveys the use of ARCH and GARCH models in applied financial econometrics.

Keywords: ARCH, GARCH, volatility, financial econometrics

## 1. Introduction

The ARCH and GARCH models have become standard tools in applied financial econometrics. They are used to model the conditional variance of a time series, which is particularly important in the context of financial returns. The ARCH model was first proposed by Engle (1982), and the GARCH model was proposed by Bollerslev (1986). Both models have since been extensively studied and applied in a wide range of financial contexts.

## 2. ARCH and GARCH Models

The ARCH model is a linear model for the conditional variance of a time series. It is defined by the following equation:

$$\sigma_t^2 = \omega + \alpha_1 \epsilon_{t-1}^2 + \alpha_2 \epsilon_{t-2}^2 + \dots + \alpha_p \epsilon_{t-p}^2$$

where  $\sigma_t^2$  is the conditional variance at time  $t$ ,  $\omega$  is a constant, and  $\alpha_1, \alpha_2, \dots, \alpha_p$  are parameters to be estimated. The GARCH model is a nonlinear model for the conditional variance of a time series. It is defined by the following equation:

$$\sigma_t^2 = \omega + \alpha_1 \epsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2 + \alpha_2 \epsilon_{t-2}^2 + \beta_2 \sigma_{t-2}^2 + \dots + \alpha_p \epsilon_{t-p}^2 + \beta_p \sigma_{t-p}^2$$

where  $\sigma_t^2$  is the conditional variance at time  $t$ ,  $\omega$  is a constant, and  $\alpha_1, \alpha_2, \dots, \alpha_p$  and  $\beta_1, \beta_2, \dots, \beta_p$  are parameters to be estimated.

The GARCH model is a nonlinear model for the conditional variance of a time series. It is defined by the following equation:

# Arch Garch Models In Applied Financial Econometrics

**Torben Gustav Andersen, Richard A.  
Davis, Jens-Peter Kreiß, Thomas V.  
Mikosch**

## **Arch Garch Models In Applied Financial Econometrics:**

Proceedings of the 9th International Conference on Financial Innovation and Economic Development (ICFIED 2024)

Khaled Elbagory,Zefu Wu,Hamdan Amer Ali Al-Jaifi,Shafie Mohamed Zabri,2024-05-07 This is an open access book

Background Financial globalization plays a huge role in promoting the development of the world economy and the optimal allocation of world resources stimulates the accelerated development of the international division of labor and increases the international flow of production factors such as industrial transfer capital transfer and technology transfer It enables developing countries to make up for the lack of their own capital and technology and obtain industrial evolution technological progress and institutional innovation thereby accelerating the speed of economic development it also enables developed countries to open up cheap labor raw material markets and broad consumer markets prolonging product value More profits ease the economy the contradiction of stagflation and restore economic growth Present situation At the current stage the overall environment of the international financial market is relatively stable and the market environment has been improved to some extent However due to the complexity and diversity of the world economy coupled with the national characteristics of some countries There is great uncertainty in international policies which has greatly affected the stability of the international financial market In addition the current international environment is changing The conflict between Russia and Ukraine the epidemic and the Taiwan issue have all had an impact on the international economic situation This is also the difference between this conference and previous conferences we hope to have a deeper discussion on the current situation

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- 4 Increasing the number of scientific publications for financial Innovation and economic development

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specialized fields of study This book which is expected to be an extensive and useful reference by bringing together some of the latest developments in the field of econometrics also contains quantitative examples and problem sets We thank all the authors who contributed to this book with their studies that provide extensive and accessible explanations of the existing econometric methods

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*GARCH 101* Robert F. Engle, 2008 ARCH and GARCH models have become important tools in the analysis of time series data particularly in financial applications These models are especially useful when the goal of the study is to analyze and forecast volatility This paper gives the motivation behind the simplest GARCH model and illustrates its usefulness in examining portfolio risk Extensions are briefly discussed *Handbook of Financial Time Series* Torben Gustav Andersen, Richard A. Davis, Jens-Peter Kreiß, Thomas V. Mikosch, 2009-04-21 The Handbook of Financial Time Series gives an up to date overview of the field and covers all relevant topics both from a statistical and an econometrical point of view There are many fine contributions and a preamble by Nobel Prize winner Robert F Engle **Encyclopedia of Financial Models, Volume I** Frank J. Fabozzi, 2012-09-12 Volume 1 of the Encyclopedia of Financial Models The need for serious coverage of financial modeling has never been greater especially with the size diversity and efficiency of modern capital markets With this in mind the Encyclopedia of Financial Models has been created to help a broad spectrum of individuals ranging from finance professionals to academics and students understand financial modeling and make use of the various models currently available Incorporating timely research and in depth analysis Volume 1 of the Encyclopedia of Financial Models covers both established and cutting edge models and discusses their real world applications Edited by Frank Fabozzi this volume includes

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