

Christophe Croux

ARCH/GARCH Models in Applied Financial Econometrics

Abstract: This paper reviews the use of ARCH/GARCH models in applied financial econometrics. It discusses the theoretical background, the estimation and testing procedures, and the applications of these models in the financial markets.

Keywords: ARCH, GARCH, volatility, financial markets

JEL Classification: C58, G10, G17

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1. Introduction

The ARCH/GARCH models have become a standard tool 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 markets.

2. ARCH/GARCH Models

The ARCH model is a special case of the GARCH model. It is defined by the following equation:

Let $\{y_t\}$ be a time series with conditional variance h_t . The ARCH model is defined by the following equation:
$$h_t = \omega + \alpha_1 y_{t-1}^2 + \alpha_2 y_{t-2}^2 + \dots + \alpha_p y_{t-p}^2$$
 where $\omega > 0$, $\alpha_i \geq 0$, and $\sum_{i=1}^p \alpha_i < 1$. The GARCH model is defined by the following equation:
$$h_t = \omega + \alpha_1 y_{t-1}^2 + \beta_1 h_{t-1} + \alpha_2 y_{t-2}^2 + \beta_2 h_{t-2} + \dots + \alpha_p y_{t-p}^2 + \beta_p h_{t-p}$$
 where $\omega > 0$, $\alpha_i \geq 0$, $\beta_i \geq 0$, and $\sum_{i=1}^p (\alpha_i + \beta_i) < 1$.

The GARCH model is a generalization of the ARCH model. It allows for a more flexible specification of the conditional variance. The GARCH model is defined by the following equation:
$$h_t = \omega + \alpha_1 y_{t-1}^2 + \beta_1 h_{t-1} + \alpha_2 y_{t-2}^2 + \beta_2 h_{t-2} + \dots + \alpha_p y_{t-p}^2 + \beta_p h_{t-p}$$
 where $\omega > 0$, $\alpha_i \geq 0$, $\beta_i \geq 0$, and $\sum_{i=1}^p (\alpha_i + \beta_i) < 1$.

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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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- 2 Understand academic development trends broaden research ideas strengthen academic research and discussion and promote the industrialization cooperation of academic achievements
- 3 Promote the institutionalization and standardization of Financial Innovation and Economic Development through modern research
- 4 Increasing the number of scientific publications for financial Innovation and economic development

Conference information As an annual conference held successfully in the past 8 years the 9th International Conference on Financial Innovation and Economic Development ICFIED 2024 will be held in Ningbo on January 12 14 2024 The conference sincerely invites experts scholars business people and other relevant personnel from domestic and foreign universities research institutions to participate in the exchange We warmly invite you to participate in ICFIED 2024 and look forward to seeing you in Ningbo China

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Handbook Of Financial Econometrics, Mathematics, Statistics, And Machine Learning (In 4 Volumes) Cheng Few Lee, John C Lee, 2020-07-30 This four volume handbook covers important concepts and tools used in the fields of financial econometrics mathematics statistics and machine learning Econometric methods have been applied in asset pricing corporate finance international finance options and futures risk management and in stress testing for financial institutions This handbook discusses a variety of econometric methods including single equation multiple regression simultaneous equation regression and panel data analysis among others It also covers statistical distributions such as the binomial and log normal distributions in light of their applications to portfolio theory and asset management in addition to their use in research regarding options and futures contracts In both theory and methodology we need to rely upon mathematics which includes linear algebra geometry differential equations Stochastic differential equation Ito calculus optimization constrained optimization and others These forms of mathematics have been used to derive capital market line security market line capital asset pricing model option pricing model portfolio analysis and others In recent times an increased importance has been

given to computer technology in financial research Different computer languages and programming techniques are important tools for empirical research in finance Hence simulation machine learning big data and financial payments are explored in this handbook Led by Distinguished Professor Cheng Few Lee from Rutgers University this multi volume work integrates theoretical methodological and practical issues based on his years of academic and industry experience *Returns & Volatility of Sectoral Indices of Nifty* Dr. T. Peddanna, Generally the fund managers prefer to include Nifty listed securities in their portfolio because they are the leading stocks of the nation using these companies constructed 11 sectors of stock indices On the whole the analysis of 12 year data starting from April 2002 to March 2014 established two phases of sectoral indices of Nifty they are pre and post recession periods in the light of sub prime financial crisis that cropped up across the globe during 2008 09 As this study revealed sector wise return exposure under different economic conditions it helps investors to diversify their funds to various sectors which give average return to their portfolios and at lower risk element However this study is helped in understanding the risk return relationship between different sectors of Nifty as well as ARCH and GARCH models to estimate the volatility in the near future in great detail The direction of the Nifty index is mainly determined by a few sectors in the long run like Bank Pharma and Capital Goods indices Finally this study is enabled the investors to understand the risk and returns of sectoral indices of Nifty to make effective portfolio decisions under different economic conditions to sustain the portfolio with the same objectives till its tenure This book is useful for Portfolio Managers Fund Managers Investment Managers and Policy makers Academicians Research scholars Post graduate students and other commerce and Management students those working on Returns and volatility of stock market indices and securities

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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