

The 2nd International Conference on Complexity Science & Information Engineering

Comparing the forecastability of alternative quantitative models: a trading simulation approach in financial engineering

Mei Zheng^{a*}, Jia Miao^b

^aNorth China Institute of Science and Technology, East Yanjiao, Beijing, 101601, China

^bCoventry University, Coventry, CV1 5FB, U.K

Abstract

In this article, we build Box-Jenkins ARMA model and ARMA-GARCH model to forecast the returns of Shanghai stock exchange composite index in financial engineering. Out-of-sample forecasting performances are evaluated to compare the forecastability of the two models. Traditional engineering type of models aim to minimize statistical errors, however, the model with minimum engineering type of statistical errors does not necessarily guarantee maximized trading profits, which is often deemed as the ultimate objective of financial application. The best way to evaluate alternative financial model is therefore to evaluate their trading performance by means of trading simulation. We find that both quantitative models are able to forecast the future movements of the market accurately, which yields significant risk adjusted returns compared to the overall market during the out-of-sample period. In addition, although the ARMA-GARCH model is better than the ARMA model theoretically and statistically, the latter outperforms the former with significantly higher trading performances.

© 2011 Published by Elsevier Ltd. Selection and peer-review under responsibility of Desheng Dash Wu.

Open access under [CC BY-NC-ND license](https://creativecommons.org/licenses/by-nc-nd/4.0/).

Keywords: financial engineering; applied engineering methodology; ARMA model; ARMA-GARCH model; investment simulation

1. Introduction

Forecasting the returns of stock markets has always been an important academic research area, while there is still debate on whether stock markets' returns are predictable at all: for instance, Campbell (1987) [1], Fama and French (1989) [2], and recently, Hjalmarsson (2010) [3], documented some out-of-sample predictability. On the other hand, however, Welch and Goyal (2007)'s comprehensive study shows little support for out-of-sample stock return predictability [4]. Among the numerous forecasting methods proposed, Box-Jenkins (1976)'s ARMA model is one of the most commonly used modeling and forecasting techniques. It is generally referred to as autoregressive moving average (ARMA) model. This methodology assumes that changes of time series data are related to its own past value. It creates an autocorrelation regression mode, usually estimated in-sample and then extended for out-of-sample

* Corresponding author. Tel.: +86-135-2047-7048; fax: +86-10-6159-4846.

E-mail address: jmz3068@hotmail.com.

forecasting [5]. Since data from financial markets are usually non-stationary, analysts can difference the original time series. However, it should be noted that, when applying Box-Jenkins method, the basic assumption is: the future pattern of a time series repeats its past pattern. It was well argued that this assumption can only be met for short-term, while forecasting accuracy tends to deteriorate over longer horizon. Later, the Autoregressive Conditional Heteroskedasticity Model (ARCH) by Engle 1982 [6], and the more generalized GARCH model by Bollerslev 1986's [7], were proposed to explain the conditional variance. These methods and their variants were used to explain volatility of some mature and emerging stock markets (e.g. Akgiray 1989 [8]; Kearney and Daly 1998 [9]; Tay and Zhu 2000 [10]; Khil and Lee 2002 [11]; and more recently, Teresiene 2009 [12]; Demireli, E. 2010 [13]).

Due to the lack of alternative investment opportunities, stock markets and their investments have contributed significant parts of investment portfolios in China. Although quite a few previous studies have been conducted to explore and model the price behaviors of stock markets, there has been little consensus on the choice of different models upon their merits or forecastability. Among these studies, Box Jenkins's ARMA model and its variant ARMA-GARCH model were adopted to forecast the return of the Chinese stock markets (among others, see more recently, Zhao 2008 [14], Huang and Wang 2010 [15], He 2011 [16]).

Among various financial engineering models, the one that has the minimal statistical error is often deemed optimal. However, the ultimate goal of investment is to make profit. The prediction model with minimal statistical errors does not necessarily guarantee maximized investment profits at the same time. The major objective of this study is thus to compare the forecastability of the ARMA model with the ARMA-GARCH model, which integrates ARMA and ARCH theories on China's Shanghai Composite index. However, unlike prior quantitative researches in the Chinese market, this study also applies investment simulation, where the projected investments profits are used to evaluate the predictability of these models. More specifically, investment simulation assumes that all models are applied with stock market investment strategies, and alternative models are compared based on their out-of-sample investment profitability.

2. Data and methodology

The financial data used in this research is the daily closing price of Shanghai Composite Index. The entire data set covers the period from 1st Jan 2001 to 31st May 2011, a total of 2562 days of observations. The data set is divided into two periods: the first data period is from 1st Jan 2001 to 31st May 2010 (2321 days of observations) while the second period is from 1st Jun 2010 to 31st May 2011 (241 days of observations). The first period, assigned to in-sample estimation, is used to determine the specifications of the models and to estimate their parameters. The second period is reserved for out-of-sample evaluation and performance comparison.

2.1. Autoregressive moving-average methodology

Box and Jenkins (1976) proposed a type of univariate time series model, which becomes very popular in financial markets. The model, known as ARMA model, combines a moving average process with a linear difference equation. The model is in such a way that the time series variable is explained purely by its own past values. The reason it is so popular in financial markets is that frequently the only data available is the single time series that of interest. The basic assumption is that the series of past value holds useful information about the future, which can be used for forecasting. The general form of an ARMA(p,q) model can be written as:

متن کامل مقاله

دریافت فوری ←

ISIArticles

مرجع مقالات تخصصی ایران

- ✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
- ✓ امکان دانلود نسخه ترجمه شده مقالات
- ✓ پذیرش سفارش ترجمه تخصصی
- ✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
- ✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
- ✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
- ✓ دانلود فوری مقاله پس از پرداخت آنلاین
- ✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات