

ISA 444: Business Forecasting

20 - ARIMA Models (Cont.)

Fadel M. Megahed

Associate Professor
Department of Information Systems and Analytics
Farmer School of Business
Miami University
Email: fmegahed@miamioh.edu
Office Hours: [Click here to schedule an appointment](#)

Fall 2020

Outline

1 Preface

2 ARIMA Models

Recap of What we Have Covered Last Three Classes

ARIMA Models: Models we considered may have three components, an autoregressive component (AR), integrated (I for differencing) and a moving average component (MA).

Main Learning Outcomes from Last 3 Classes

- Describe the behavior of the ACF and PACF of an $AR(p)$ process.
- Describe the behavior of the ACF and PACF of an $MA(q)$ process.
- Describe the behavior of the ACF and PACF of an $ARMA(p,q)$ process.
- Fit an ARMA model to a time series, evaluate the residuals of a fitted ARMA model to assess goodness of fit, use the Ljung-Box test for correlation among the residuals of an ARIMA model.
- Use nonseasonal differencing to attain stationarity for a time series.
- Fit an AIRMA model to a time series, evaluate the residuals of a fitted ARMA model to assess goodness of fit, use the Ljung-Box test for correlation among the residuals of an ARIMA model.
- R: Convert data into a time-series, and forecast future values of a

Learning Outcomes for Today's Class

Main Learning Outcomes

- Show that you can fit reasonable ARIMA models based on both simulated and actual data cases.

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ARIMA Models for Nonstationary Processes

When the time series is nonstationary, differencing can be used to transform the series. The ADF or KPSS tests can be used to test for stationarity, and the `ndiffs()` function is useful for determining the number of differences necessary to achieve stationarity.

A Live-Example

In class, we will use the [GNP Data](#) to highlight how ARIMA models can be fit and used for forecasting.

Non-graded In-Class Activity 1

You have 15 minutes to examine and model `series10` in `20 - InClass ARIMA Practice.csv`, where you should:

- Determine an appropriate model to fit based on examining the output from the `ndiffs()`, examining both the `acf()` and `pacf()` of your data (or differenced data), and the output from the `checkresiduals()`.
- Once you fit an appropriate model, return its accuracy metrics and use it to forecast the values of the time-series for the next 10 time periods

Non-graded In-Class Activity 2

You have 15 minutes to examine and model `toothpaste` in [20 - tothpaste.csv](#), where you should:

- Determine an appropriate model to fit based on examining the output from the `ndiffs()`, examining both the `acf()` and `pacf()` of your data (or differenced data), and the output from the `checkresiduals()`.
- Once you fit an appropriate model, return its accuracy metrics and use it to forecast the values of the time-series for the next 10 time periods.

Things to Do to Prepare for Next Class

- Thoroughly read Chapters 6.2 of our textbook.
- Go through the slides, examples and make sure you have a good understanding of what we have covered.

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