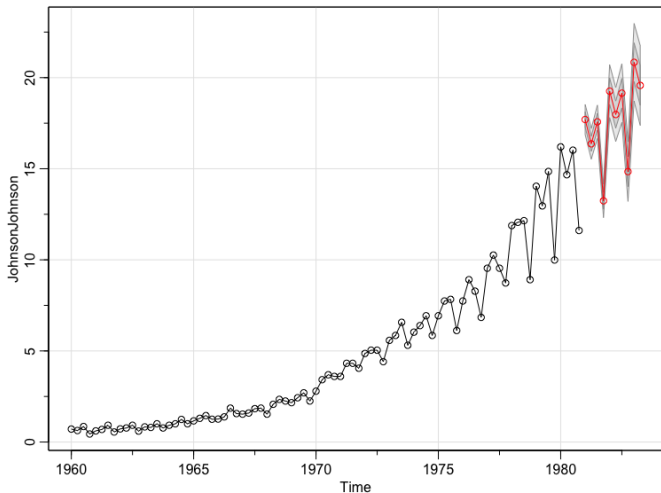


STAT 153 - Introduction to Time Series

with Jared Fisher



My email `jared.fisher@berkeley.edu` *

* for private concerns, otherwise please use Piazza

GSI's and Friday Lab Sections

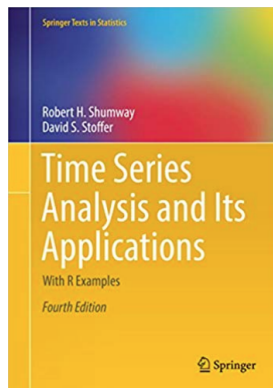
GSIs: Frank Qiu and Miyabi Ishihara

Labs start next Friday. In lieu of lab this week, I'm posting an optional worksheet review of concepts needed for this course (i.e. prereqs). Please take the time zone poll!

Introduction to the Course

You're watching my screen anyway, so let's look at the actual syllabus!

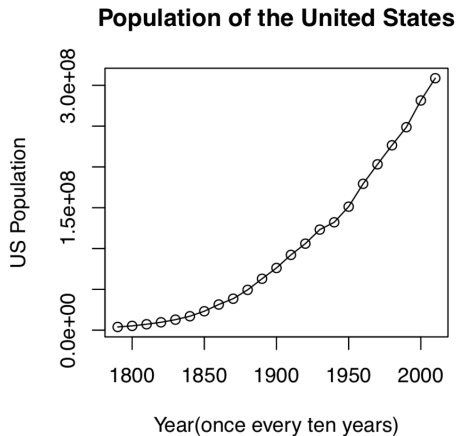
Time Series Analysis and its Applications by Shumway and Stoffer, *fourth edition*. It is available for free via the library website.



Any Questions?

5 minute break, then we'll talk about time series!

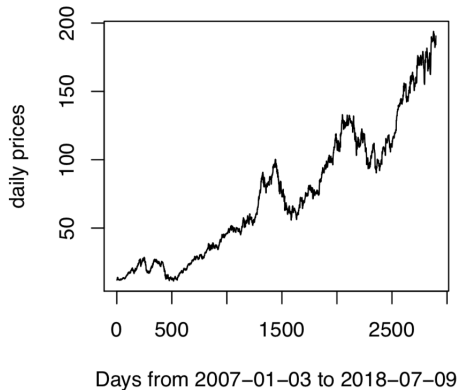
Population Data



Data: US Census Bureau

Financial Data - Apple Stock price

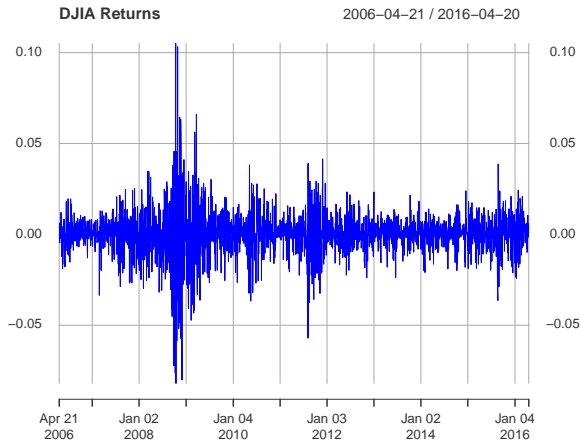
Stock prices of Apple Inc. (AAPL) stock



Financial Data - Dow Jones

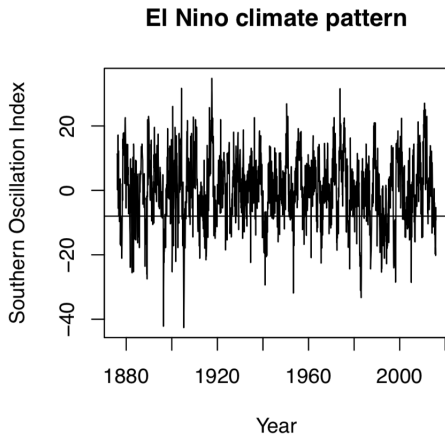


Financial Data - Dow Jones Returns



Example 1.4 - note the daily return $= \frac{P_t - P_{t-1}}{P_{t-1}} \approx \log \left(\frac{P_t}{P_{t-1}} \right)$

Climate Data - El Nino



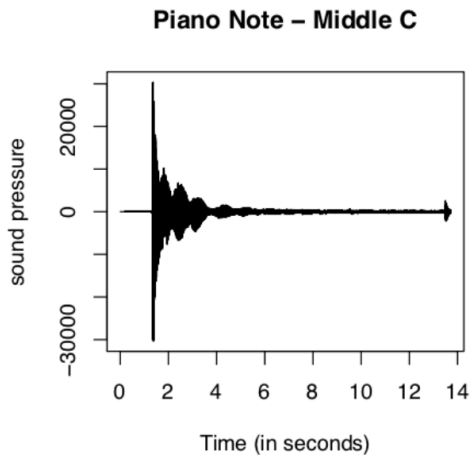
Data: Australian Government Bureau of Meteorology

Audio Data - Piano

Piano Note - Middle C

www.youtube.com/watch?v=FtqgqYRDTDg

Audio Data - Piano



Data: ? (Thanks Dr. Behr!)

Google's Cool Time Series Data

<https://trends.google.com>

<https://books.google.com/ngrams>

Why Time Series?

- ▶ Many statistics classes - assume a simple random sample: N independent, identically distributed observations (iid)

Why Time Series?

- ▶ Many statistics classes - assume a simple random sample: N independent, identically distributed observations (iid)
- ▶ Time series classes - N observations taken sequentially over time, so not independent and/or identically distributed!

Objectives

- ▶ Build models that plausibly describe the time series

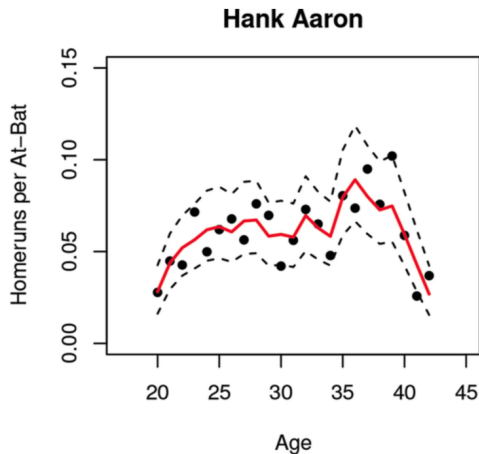
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- ▶ Build models that plausibly describe the time series
- ▶ Learn how to estimate these models

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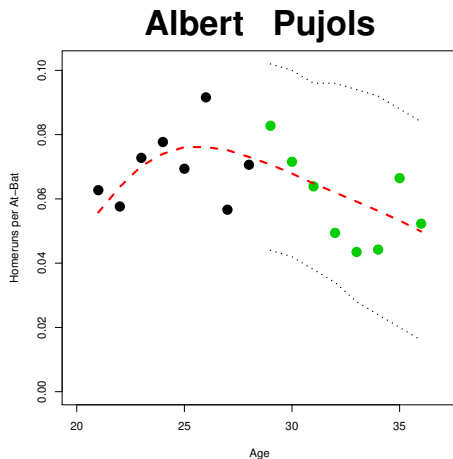
- ▶ Build models that plausibly describe the time series
- ▶ Learn how to estimate these models
- ▶ Learn how to predict/forecast with these models

Example: Baseball



Data: Lahman Database, Figure: Fellingham and Fisher (2018)

Example: Baseball



Data: Lahman Database, Figure: Fellingham and Fisher (2018)

Topics - A Tentative List

- ▶ Basics
 - ▶ Weak and strong stationarity
- ▶ Pursuing stationarity
 - ▶ Trend and seasonality models
 - ▶ Best linear prediction
 - ▶ Discrete Fourier transform and spectral density
 - ▶ Time invariant filters and power transfer function
- ▶ Modeling stationary processes
 - ▶ Moving average (MA), autoregressive (AR), ARMA models
 - ▶ Estimation: method of moments, least squares, maximum likelihood
 - ▶ ARIMA and SARIMA models
 - ▶ Diagnostics and model selection (AIC/BIC, crossvalidation)