MANIPULATING TIME SERIES DATA IN R WITH XTS & ZOO

Welcome To The Course

About myself

- Creator & co-creator of a variety of packages:
  - xts
  - quantmod
  - zoo
- Co-founded R/Finance conference
  - http://www.rinfinance.com

Course Overview

- **Chapter 1:** *Create, import, and export time-series*
- **Chapter 2:** *Subsetting, extraction, and more*
- **Chapter 3:** *Merging & modifying time-series*
- **Chapter 4:** *Apply and aggregate by time period(s)*
- **Chapter 5:** *Advanced and extra features of xts*

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Let’s practice!

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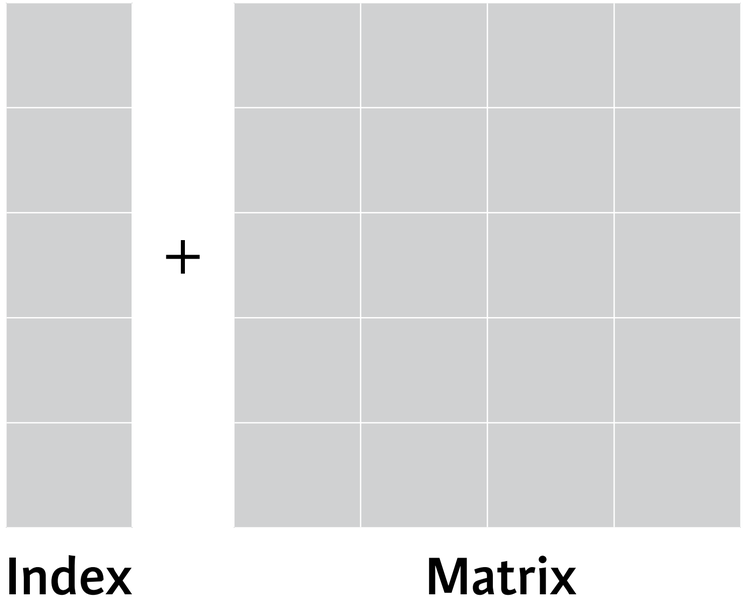
Introducing xts and zoo objects

What is xts?

- eXtensible Time Series
- An extended zoo object
- Matrix + Index
- Observations + Times



An xts example

```
> # XTS = MATRIX + INDEX

> x <- matrix(1:4, ncos = 2, nrow = 2)
> x
     [,1] [,2]
[1,]    1    3
[2,]    2    4

> idx <- as.Date(c("2015-01-01", "2015-02-01"))
> idx
[1] "2015-01-01" "2015-02-01"
```

- Class: Date, POSIX times, timeDate, chron,...

An xts example

```
> # XTS = MATRIX + INDEX

> X <- xts(x, order.by = idx)
> X
            [,1] [,2]
2015-01-01    1    3
2015-02-01    2    4
```

The xts constructor

```
xts(x = NULL,
    order.by = index(x),
    frequency = NULL,
    unique = NULL,
    tzone = Sys.getenv("TZ"))
```

- tzone ⇒ time zone of your series
- unique ⇒ forces times to be unique
- index is in increasing order of time

An xts example

```
> # XTS = MATRIX + INDEX

> X <- xts(x, order.by = idx)
> X
            [,1] [,2]
2015-01-01    1    3
2015-02-01    2    4
```

Special xts behavior

- xts is a matrix with associated times for each observation
- Subsets preserve matrix form
- Attributes are preserved
  - i.e. a time-stamp that was acquired
- xts is a subclass of zoo

Deconstructing xts

- Use internal components
- coredata(x) is used to extract the data component

```
coredata(x, fmt = FALSE)
```

- index(x) to extract the index a.k.a. times

```
index(x)
```

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Importing, exporting and converting time series

Reality check

- Data usually already exists, and needs wrangling
    - Often data isn’t in your preferred class
- Data needs to be imported into R and converted to xts
- You will convert, read and export xts objects

Converting using as.xts

```
# Load data from R datasets
> data(sunspots)
> class(sunspots)
[1] "ts"

> sunspots_xts <- as.xts(sunspots)
> class(sunspots_xts)
[1] "xts" "zoo"
```

```
> head(sunspots_xts)
          [,1]
Jan 1749 58.0
Feb 1749 62.6
Mar 1749 70.0
Apr 1749 55.7
May 1749 85.0
Jun 1749 83.5
```

Importing external data to xts

- Read data into R using built in (or external) functions
  - i.e. read.table(), read.csv(), and read.zoo()
- Coerce data to xts using as.xts()

```
> as.xts(read.table("file"))
> as.xts(read.zoo("file"))
```

Exporting xts from R

- Sometimes you will need your data outside of R
- Use write.zoo() for external use (i.e. text files)

```
> write.zoo(x, “file”)
```

- Use saveRDS for R use

```
> saveRDS(x, “file”)
```

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