

Manipulating Time Series Data with xts and zoo in R

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Time Series Data with xts and zoo

xts stands for Extensible Time Series

```
library(xts)
```

```
## Loading required package: zoo
```

```
##
```

```
## Attaching package: 'zoo'
```

```
## The following objects are masked from 'package:base':
```

```
##
```

```
##      as.Date, as.Date.numeric
```

```
library(zoo)
```

```
# XTS = MATRIX + INDEX
```

```
x <- matrix(1:6, ncol = 2, nrow = 3)
```

```
x
```

```
##      [,1] [,2]
```

```
## [1,]    1    4
```

```
## [2,]    2    5
```

```
## [3,]    3    6
```

```
idx <- as.Date(c("2020-05-09", "1989-05-09", "2019-09-17"))
```

```
idx
```

```
## [1] "2020-05-09" "1989-05-09" "2019-09-17"
```

```
X <- xts(x = x, order.by = idx) # R will assign the DF with the time data, and reorder the DF based on X
```

```
##      [,1] [,2]
```

```
## 1989-05-09    2    5
```

```
## 2019-09-17    3    6
```

```
## 2020-05-09    1    4
```

```

# Create the object data using 5 random numbers
data <- rnorm(5)

# Create dates as a Date class object starting from 2016-01-01
dates <- seq(as.Date("2016-01-01"), length = 5, by = "days")

# Use xts() to create smith
smith <- xts(x = data, order.by = dates)

# Create bday (1899-05-08) using a POSIXct date class object
bday <- as.POSIXct("1899-05-08")

# Create hayek and add a new attribute called born
hayek <- xts(x = data, order.by = dates, born = bday)

attributes(smith)

```

```

## $dim
## [1] 5 1
##
## $index
## [1] 1451606400 1451692800 1451779200 1451865600 1451952000
## attr(,"tzone")
## [1] "UTC"
## attr(,"tclass")
## [1] "Date"
##
## $class
## [1] "xts" "zoo"

```

```
attributes(hayek)
```

```

## $dim
## [1] 5 1
##
## $index
## [1] 1451606400 1451692800 1451779200 1451865600 1451952000
## attr(,"tzone")
## [1] "UTC"
## attr(,"tclass")
## [1] "Date"
##
## $class
## [1] "xts" "zoo"
##
## $born
## [1] "1899-05-08 CST"

```

```

# Extract the core data of hayek
hayek_core <- coredata(hayek)

# View the class of hayek_core
class(hayek_core)

```

```
## [1] "matrix" "array"
```

```
# Extract the index of hayek
hayek_index <- index(hayek)

# View the class of hayek_index
class(hayek_index)
```

```
## [1] "Date"
```

```
# Create dates
dates <- as.Date("2016-01-01") + 0:4

# Create ts_a
ts_a <- xts(x = 1:5, order.by = dates)

# Create ts_b
ts_b <- xts(x = 1:5, order.by = as.POSIXct(dates))

# Extract the rows of ts_a using the index of ts_b
ts_a[index(ts_b)]
```

```
##           [,1]
## 2016-01-01    1
## 2016-01-02    2
## 2016-01-03    3
## 2016-01-04    4
## 2016-01-05    5
```

```
# Extract the rows of ts_b using the index of ts_a
ts_b[index(ts_a)]
```

```
##           [,1]
```

```
data("sunspots")
class(sunspots)
```

```
## [1] "ts"
```

```
head(sunspots)
```

```
## [1] 58.0 62.6 70.0 55.7 85.0 83.5
```

```
sunspots_xts <- as.xts(sunspots)
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
```

```

# Convert austres to an xts object called au
au <- as.xts(austres)

# Then convert your xts object (au) into a matrix am
am <- as.matrix(au)

# Inspect the head of am
head(am)

```

```

##              au
## 1971 Q2 13067.3
## 1971 Q3 13130.5
## 1971 Q4 13198.4
## 1972 Q1 13254.2
## 1972 Q2 13303.7
## 1972 Q3 13353.9

```

```

# Convert the original austres into a matrix am2
am2 <- as.matrix(austres)

# Inspect the head of am2
head(am2)

```

```

##           [,1]
## [1,] 13067.3
## [2,] 13130.5
## [3,] 13198.4
## [4,] 13254.2
## [5,] 13303.7
## [6,] 13353.9

```

```

first(sunspots_xts, "5 months")

```

```

##           [,1]
## Jan 1749 58.0
## Feb 1749 62.6
## Mar 1749 70.0
## Apr 1749 55.7
## May 1749 85.0

```

```

last(sunspots_xts, "2 years")

```

```

##           [,1]
## Jan 1982 111.2
## Feb 1982 163.6
## Mar 1982 153.8
## Apr 1982 122.0
## May 1982  82.2
## Jun 1982 110.4
## Jul 1982 106.1
## Aug 1982 107.6

```

```
## Sep 1982 118.8
## Oct 1982 94.7
## Nov 1982 98.1
## Dec 1982 127.0
## Jan 1983 84.3
## Feb 1983 51.0
## Mar 1983 66.5
## Apr 1983 80.7
## May 1983 99.2
## Jun 1983 91.1
## Jul 1983 82.2
## Aug 1983 71.8
## Sep 1983 50.3
## Oct 1983 55.8
## Nov 1983 33.3
## Dec 1983 33.4
```

notes

- Use `rbind` to add rows from multiple xts
- Use `join` to merge multiple xts with different column
- Use `na.locf()` to fill missing value with the previous date value. Add parameter `fromLast` to fill the missing value with the next date value.
- Use `na.approx()` to fill missing value with interpolate value using linear approximation.
- Use `split()` to split the data by week, month, year, etc.
- Use `to.period()` to get OHLC information by month, year, week, etc.
- Use `index()` to get the time index.
- Use `indexClass()` to get the index class.
- Use `indexFormat()` to get or set the index time format.
- Use `tzzone()` to get the time zone of the index.