Quick and Dirty Intro to R Markdown

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Working with Financial Data

Let's take a simple example of importing financial price data using quantmod, calculating the returns, and plotting the results. Various points about R Markdown with be presented as we progress through the discussion.

Some Initial Formatting Details First

Note that in order to drop down on vertical space, we need to end this paragraph with two white spaces.
See how the text dropped down by one line? But, what if we want more than one line? For that, we need to end this paragraph with two white spaces, followed by another line with two whit spaces.

Now, I've dropped down two lines, and started a new paragraph properly. One more thing to note, though, is that R Markdown has no spell check. In the end of the last sentence in the last paragraph, I should have put *white* instead of *whit*.

You might also be asking, how did I put words in *italics*? If you look at the Rmd file, you'll see the word is enclosed in two asterisks. It is also possible to put the *text inside two underscore characters*; again, you'll need to look at the Rmd file.

If you're after stronger emphasis, or just plain angry, you can **put in a bold font**. This is accomplished by surrounding your text in double asterisks. Likewise, **one can use double underscores**. Finally, if you want both italics and bold, the way your instructor does it is with ***double underscores on the outside with single asterisks on the inside***. There exist other variations.

Import Financial Data

Let's bring in Amazon price data again, and check the head and the tail. Note that we put `{r}` at the top to indicate we are embedding r code and wish to have the console results output into the pdf file. The end of the code bloc is indicated by three back ticks, as shown in the Rmd file.

Note that the `echo = FALSE` parameter was added to the code chunk to prevent printing of the R code that generated the plot.

```
library(quantmod)
```

```
## Loading required package: xts
```

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

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

## The following objects are masked from 'package:base':
##
##     as.Date, as.Date.numeric

## Registered S3 method overwritten by 'xts':
##   method     from
##   as.zoo.xts zoo

## Loading required package: TTR

## Registered S3 method overwritten by 'quantmod':
##   method            from
##   as.zoo.data.frame zoo

## Version 0.4-0 included new data defaults. See ?getSymbols.
```

```
# We can also put comments in the embedded R code
# in the usual way with the hash marks.
getSymbols("AMZN", from = "2010-12-31", to = "2013-12-31")
```

```
## 'getSymbols' currently uses auto.assign=TRUE by default, but will
## use auto.assign=FALSE in 0.5-0. You will still be able to use
## 'loadSymbols' to automatically load data. getOption("getSymbols.env")
## and getOption("getSymbols.auto.assign") will still be checked for
## alternate defaults.
##
## This message is shown once per session and may be disabled by setting
## options("getSymbols.warning4.0"=FALSE). See ?getSymbols for details.

## [1] "AMZN"
```

```
head(AMZN)
```

```
##            AMZN.Open AMZN.High AMZN.Low AMZN.Close AMZN.Volume AMZN.Adjusted
## 2010-12-31    181.96    182.30   179.51     180.00     3451900        180.00
## 2011-01-03    181.37    186.00   181.21     184.22     5331400        184.22
## 2011-01-04    186.15    187.70   183.78     185.01     5031800        185.01
## 2011-01-05    184.10    187.45   184.07     187.42     3418800        187.42
## 2011-01-06    186.50    187.41   185.25     185.86     3179700        185.86
## 2011-01-07    187.88    188.45   183.74     185.49     5221700        185.49
```

```
tail(AMZN)
```

```
##            AMZN.Open AMZN.High AMZN.Low AMZN.Close AMZN.Volume AMZN.Adjusted
## 2013-12-20    396.55    404.72   395.78     402.20     5033900        402.20
## 2013-12-23    403.69    405.00   399.20     402.92     2659500        402.92
## 2013-12-24    402.52    403.72   396.37     399.20     1380400        399.20
## 2013-12-26    401.79    404.52   396.81     404.39     1868500        404.39
## 2013-12-27    404.65    405.63   396.25     398.08     1986900        398.08
## 2013-12-30    399.41    399.92   392.45     393.37     2487100        393.37
```

Note that we can get a lot of garbage output, especially if this is the first time the `library(quantmod)` command is called. We can eliminate it as follows:

```
rm(list = ls())   # unload quantmod so we can load it again
library(quantmod)

# We can also put comments in the embedded R code
# in the usual way with the hash marks.
getSymbols("AMZN", from = "2010-12-31", to = "2013-12-31")
```

Then, run the `head` and `tail` commands without this parameter to display the results:

```
head(AMZN)
```

```
##            AMZN.Open AMZN.High AMZN.Low AMZN.Close AMZN.Volume AMZN.Adjusted
## 2010-12-31    181.96    182.30   179.51     180.00     3451900        180.00
## 2011-01-03    181.37    186.00   181.21     184.22     5331400        184.22
## 2011-01-04    186.15    187.70   183.78     185.01     5031800        185.01
## 2011-01-05    184.10    187.45   184.07     187.42     3418800        187.42
## 2011-01-06    186.50    187.41   185.25     185.86     3179700        185.86
## 2011-01-07    187.88    188.45   183.74     185.49     5221700        185.49
```

```
tail(AMZN)
```

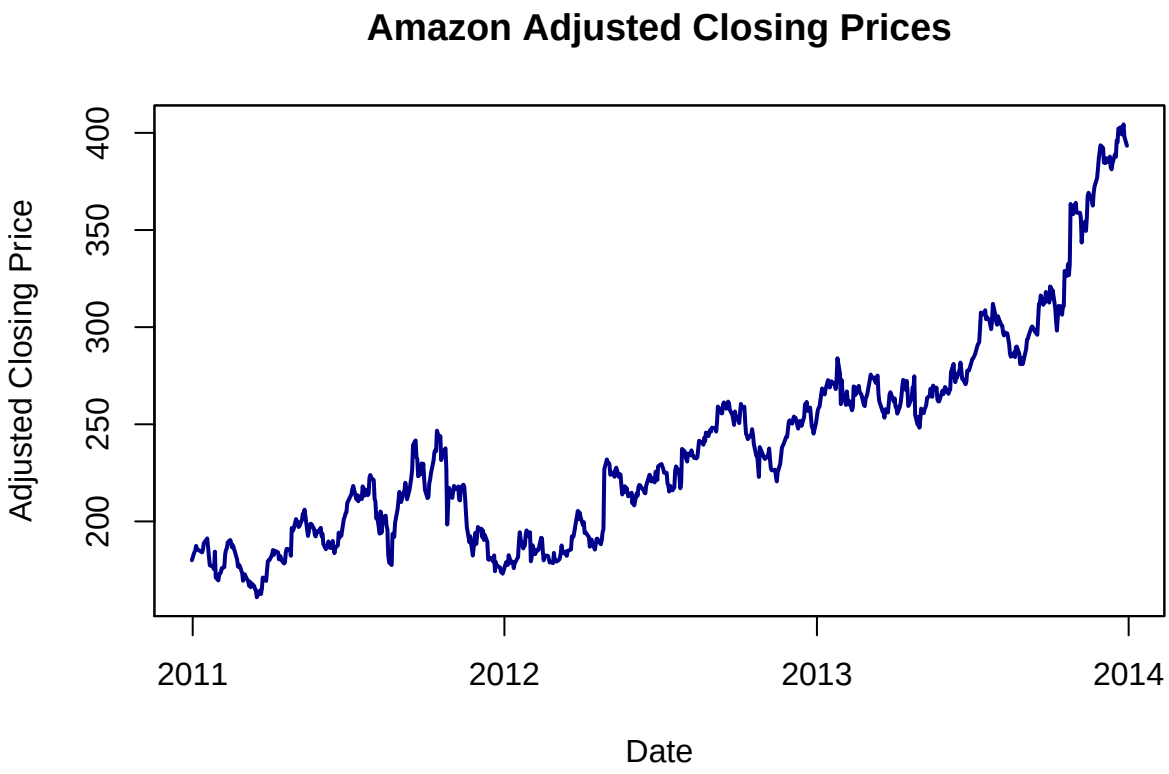
```
##            AMZN.Open AMZN.High AMZN.Low AMZN.Close AMZN.Volume AMZN.Adjusted
## 2013-12-20    396.55    404.72   395.78     402.20     5033900        402.20
## 2013-12-23    403.69    405.00   399.20     402.92     2659500        402.92
## 2013-12-24    402.52    403.72   396.37     399.20     1380400        399.20
## 2013-12-26    401.79    404.52   396.81     404.39     1868500        404.39
## 2013-12-27    404.65    405.63   396.25     398.08     1986900        398.08
## 2013-12-30    399.41    399.92   392.45     393.37     2487100        393.37
```

At this point, you might be wondering how we made R commands such as `head`, `tail`, and `library(quantmod)` appear in a font that looks like code. The answer is to embed such text inside single back ticks, as shown in the Rmd file.

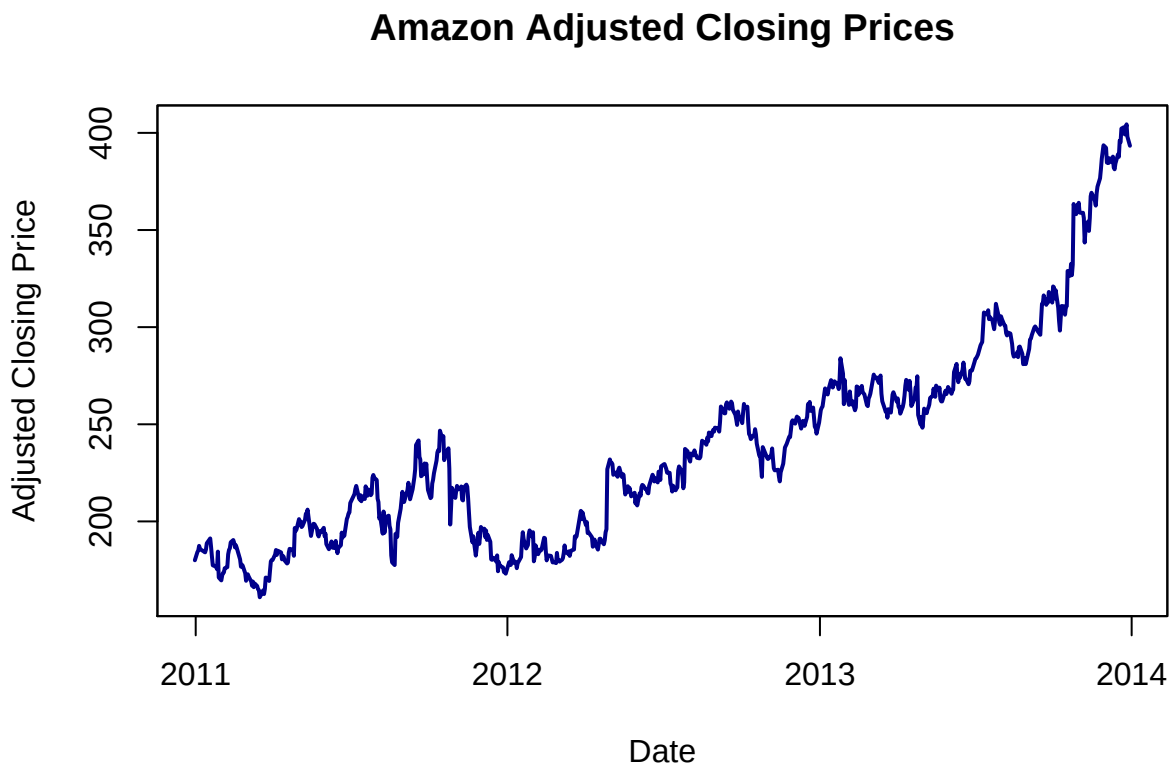
Plotting the Adjusted Prices

In this case, we just put the plot command inside the code block, and let it rip:

```
# Downcast to zoo if you wish to use xlab and ylab:
zoo.AMZN <- as.zoo(AMZN)
plot(zoo.AMZN$AMZN.Adjusted, col = "darkblue", lwd = 2.0, xlab = "Date",
     ylab = "Adjusted Closing Price", main = "Amazon Adjusted Closing Prices")
```



Now, what if we wanted to just embed the plot without the R code shown? Use the parameter `echo = FALSE` parameter at the top of the code chunk to prevent printing of the R code that generated the plot:



Calculating and Plotting Returns

To obtain log returns, we need to calculate $\log(S_t/S_{t-1})$ for each pair of adjacent equity prices.

Mathematical Notation

First, how did we display mathematical notation? Also, how can we drop it down a line like this?

$$\log(S_t/S_{t-1})$$

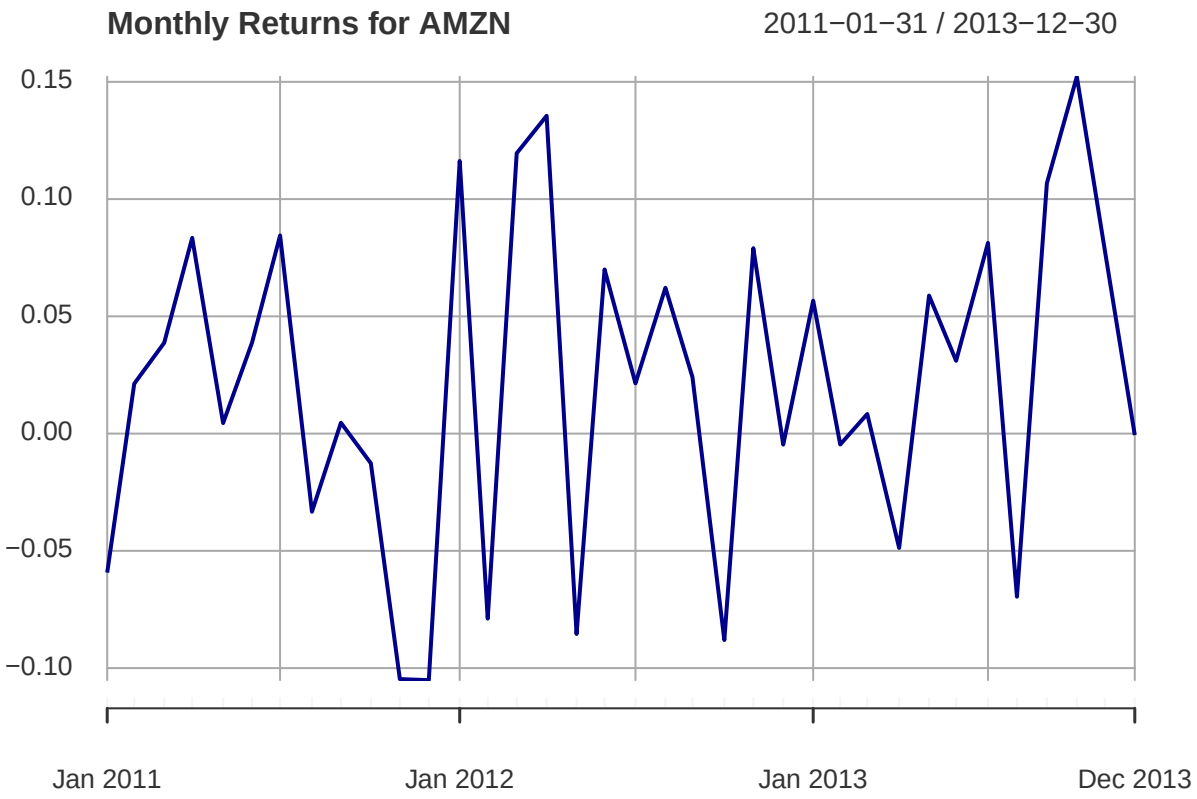
You can see how this particular example was done by examining the Rmd file. For a more detailed discussion on a wide variety of mathematical formulae, refer to this very nicely presented web page:

https://www.calvin.edu/~rpruim/courses/s341/S17/from-class/MathinRmd.html

With more practice, you'll get used to it and be able to type them without having to look at the guide.

Calculate and Plot the Monthly Adjusted log Returns

Now, just embed the R code from class, but let's again leave out the console output for the process:



Summary

There is much more to learn about R Markdown, including subtleties such as sizing plots, embedding external imagine, inserting bullet points and numbering, using footnotes, etc, but these are things you should be able to pick up on your own, by creating more and more documents. You should also find these online references helpful:

https://rmarkdown.rstudio.com/articles_intro.html

https://bookdown.org/yihui/rmarkdown/pdf-document.html

https://rmarkdown.rstudio.com/authoring_quick_tour.html

https://rstudio.com/wp-content/uploads/2015/02/rmarkdown-cheatsheet.pdf