

Portfolio

```
data.file <- file.path(data.dir, "Reproducible Finance.csv")

symbols <- c("SPY", "EFA", "IJS", "EEM", "AGG")

# Yahoo! Finance

prices <- getSymbols(symbols,
  from = "2012-12-31",
  to = "2017-12-31",
  auto.assign = T,
  warnings = F) %>%
  map(~Ad(get(.))) %>%
  reduce(merge) %>%
  `colnames<-`(symbols)
```

'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.

CSV

```
prices <- read_csv(data.file,
  col_types =
    cols(date =
      col_date(format = "%Y-%m-%d"))) %>%
  tk_xts(date_var = date)
```

Warning in tk_xts_.data.frame(data = data, select = select, date_var = date_var, : Non-numeric columns being dropped: date

Excel

```
prices <-
  read_excel("Reproducible Finance.xlsx",
    col_types = c("text", "numeric",
      "numeric", "numeric",
      "numeric", "numeric")) %>%
  mutate(date = ymd(date)) %>%
  tk_xts(date_var = date)
```

```
Warning in tk_xts_.data.frame(data = data, select = select, date_var =
date_var, : Non-numeric columns being dropped: date
```

```
# Verfiy Import
head(prices, 3)
```

	SPY	EFA	IJS	EEM	AGG
2012-12-31	128.3092	49.16410	75.06590	39.89233	98.19626
2013-01-02	131.5977	49.92501	77.12553	40.67489	98.08131
2013-01-03	131.3004	49.44080	77.02349	40.38705	97.83374

```
# convert to monthly prices.
```

```
prices_monthly <- to.monthly(prices,
                             indexAt = "lastof",
                             OHLC = F)
```

```
head(prices_monthly)
```

	SPY	EFA	IJS	EEM	AGG
2012-12-31	128.3092	49.16410	75.06590	39.89233	98.19626
2013-01-31	134.8773	50.99717	79.08315	39.77539	97.58625
2013-02-28	136.5982	50.34004	80.37274	38.86691	98.16285
2013-03-31	141.7850	50.99717	83.67441	38.47113	98.25957
2013-04-30	144.5090	53.55654	83.77677	38.93888	99.21130
2013-05-31	147.9209	51.93964	87.36826	37.05894	97.22598

```
# Convert to monthly returns, xts.
```

```
asset_returns_xts <-
  Return.calculate(prices_monthly,
                   method = "log") %>%
  na.omit()
```

```
head(asset_returns_xts, 3)
```

	SPY	EFA	IJS	EEM	AGG
2013-01-31	0.04992297	0.03660636	0.05213343	-0.002935495	-0.006231517
2013-02-28	0.01267831	-0.01296938	0.01617522	-0.023105260	0.005891222
2013-03-31	0.03726793	0.01296938	0.04025808	-0.010235026	0.000984796

```
# Convert to monthly returns, dplyr.
```

```
asset_returns_dplyr_byhand <-
  prices %>%
  to.monthly(indexAt = "lastof", OHLC = F) %>%
  # convert the index to a date
  data.frame(date = index(.)) %>%
```

```
# now remove the index because it got converted to row names
remove_rownames() %>%
gather(asset, prices, - date) %>%
group_by(asset) %>%
mutate(returns = (log(prices) - log(lag(prices)))) %>%
select(-prices) %>%
spread(asset, returns) %>%
select(date, symbols)
```

```
head(asset_returns_dplyr_byhand)
```

```
# A tibble: 6 x 6
  date      SPY      EFA      IJS      EEM      AGG
<date>    <dbl>    <dbl>    <dbl>    <dbl>    <dbl>
1 2012-12-31 NA      NA      NA      NA      NA
2 2013-01-31 0.0499 0.0366 0.0521 -0.00294 -0.00623
3 2013-02-28 0.0127 -0.0130 0.0162 -0.0231 0.00589
4 2013-03-31 0.0373 0.0130 0.0403 -0.0102 0.000985
5 2013-04-30 0.0190 0.0490 0.00122 0.0121 0.00964
6 2013-05-31 0.0233 -0.0307 0.0420 -0.0495 -0.0202
```

```
asset_returns_dplyr_byhand <- asset_returns_dplyr_byhand %>%
  na.omit()
```

```
head(asset_returns_dplyr_byhand)
```

```
# A tibble: 6 x 6
  date      SPY      EFA      IJS      EEM      AGG
<date>    <dbl>    <dbl>    <dbl>    <dbl>    <dbl>
1 2013-01-31 0.0499 0.0366 0.0521 -0.00294 -0.00623
2 2013-02-28 0.0127 -0.0130 0.0162 -0.0231 0.00589
3 2013-03-31 0.0373 0.0130 0.0403 -0.0102 0.000985
4 2013-04-30 0.0190 0.0490 0.00122 0.0121 0.00964
5 2013-05-31 0.0233 -0.0307 0.0420 -0.0495 -0.0202
6 2013-06-30 -0.0134 -0.0272 -0.00140 -0.0547 -0.0158
```

```
# convert to monthly returns, tidyquant.
```

```
asset_returns_tq_builtin <-
  prices %>%
  tk_tbl(preserve_index = T,
         rename_index = "date") %>%
  gather(asset, prices, -date) %>%
  group_by(asset) %>%
  tq_transmute(mutate_fun = periodReturn,
               period = "monthly",
```

```

      type = "log") %>%
spread(asset, monthly.returns) %>%
select(date, symbols) %>%
slice(-1)

head(asset_returns_tq_builtin)

# A tibble: 6 x 6
  date      SPY      EFA      IJS      EEM      AGG
  <date>    <dbl>    <dbl>    <dbl>    <dbl>    <dbl>
1 2013-01-31 0.0499 0.0366 0.0521 -0.00294 -0.00623
2 2013-02-28 0.0127 -0.0130 0.0162 -0.0231 0.00589
3 2013-03-28 0.0373 0.0130 0.0403 -0.0102 0.000985
4 2013-04-30 0.0190 0.0490 0.00122 0.0121 0.00964
5 2013-05-31 0.0233 -0.0307 0.0420 -0.0495 -0.0202
6 2013-06-28 -0.0134 -0.0272 -0.00140 -0.0547 -0.0158

```

convert to monthly returns, tibbletime.

```

asset_returns_tbltime <-
  prices %>%
  tk_tbl(preserve_index = T,
         rename_index = "date") %>%
  # this is the tibbletime function
  as_tbl_time(index = date) %>%
  as_period(period = "monthly",
            side = "end") %>%
  gather(asset, returns, - date) %>%
  group_by(asset) %>%
  tq_transmute(mutate_fun = periodReturn,
               type = "log") %>%
  spread(asset, monthly.returns) %>%
  select(date, symbols) %>%
  slice(-1)

head(asset_returns_tbltime)

```

```

# A time tibble: 6 x 6
# Index: date
  date      SPY      EFA      IJS      EEM      AGG
  <date>    <dbl>    <dbl>    <dbl>    <dbl>    <dbl>
1 2013-01-31 0.0499 0.0366 0.0521 -0.00294 -0.00623
2 2013-02-28 0.0127 -0.0130 0.0162 -0.0231 0.00589
3 2013-03-28 0.0373 0.0130 0.0403 -0.0102 0.000985
4 2013-04-30 0.0190 0.0490 0.00122 0.0121 0.00964

```

```
5 2013-05-31 0.0233 -0.0307 0.0420 -0.0495 -0.0202
6 2013-06-28 -0.0134 -0.0272 -0.00140 -0.0547 -0.0158
```

```
asset_returns_long <-
  asset_returns_dplyr_byhand %>%
  gather(asset, returns, - date) %>%
  group_by(asset)

head(asset_returns_long)
```

```
# A tibble: 6 x 3
# Groups:   asset [1]
  date      asset returns
  <date>    <chr>   <dbl>
1 2013-01-31 SPY     0.0499
2 2013-02-28 SPY     0.0127
3 2013-03-31 SPY     0.0373
4 2013-04-30 SPY     0.0190
5 2013-05-31 SPY     0.0233
6 2013-06-30 SPY    -0.0134
```

```
# visualize return data
```

```
highchart(type = "stock") %>%
  hc_title(text = "Monthly Log Returns") %>%
  hc_add_series(asset_returns_xts[, symbols[1]],
    name = symbols[1]) %>%
  hc_add_series(asset_returns_xts[, symbols[2]],
    name = symbols[2]) %>%
  hc_add_series(asset_returns_xts[, symbols[3]],
    name = symbols[3]) %>%
  hc_add_series(asset_returns_xts[, symbols[4]],
    name = symbols[4]) %>%
  hc_add_series(asset_returns_xts[, symbols[5]],
    name = symbols[5]) %>%
  hc_add_theme(hc_theme_flat()) %>%
  hc_navigator(enabled = F) %>%
  hc_scrollbar(enabled = F) %>%
  hc_exporting(enabled = T) %>%
  hc_legend(enabled = T)
```

PhantomJS not found. You can install it with `webshot::install_phantomjs()`. If it is installed,

```
hc_hist_fun <- function(n = 1, object, color) {
  hc_hist <- hist(object[, symbols[n]],
    breaks = 50,
```

```
      plot = F)

hchart(hc_hist, color = color) %>%
  hc_title(text =
    paste(symbols[n],
          "Log Returns Distribution",
          sep = " ")) %>%
  hc_add_theme(hc_theme_flat()) %>%
  hc_exporting(enabled = F) %>%
  hc_legend(enabled = F)
}

hc_hist_fun(1, asset_returns_xts, "cornflowerblue")

hc_hist_fun(2, asset_returns_xts, "green")

hc_hist_fun(3, asset_returns_xts, "pink")

hc_hist_fun(4, asset_returns_xts, "purple")

hc_hist_fun(5, asset_returns_xts, "yellow")

map(1:5, hc_hist_fun, asset_returns_xts, "blue")

[[1]]

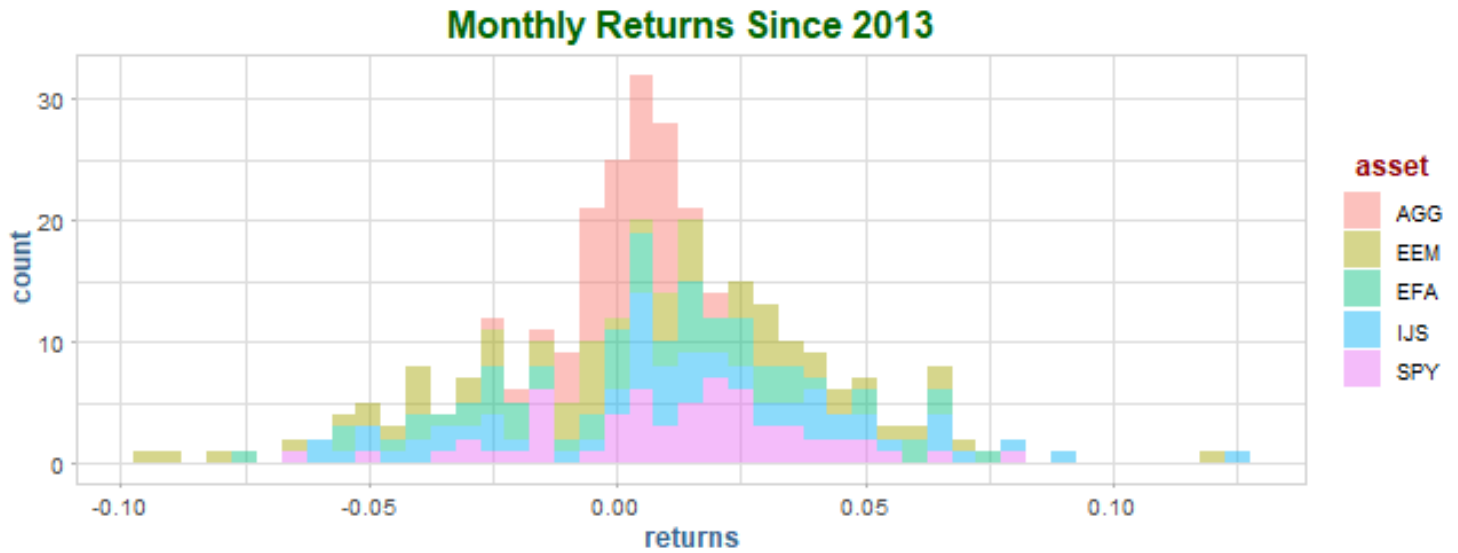
[[2]]

[[3]]

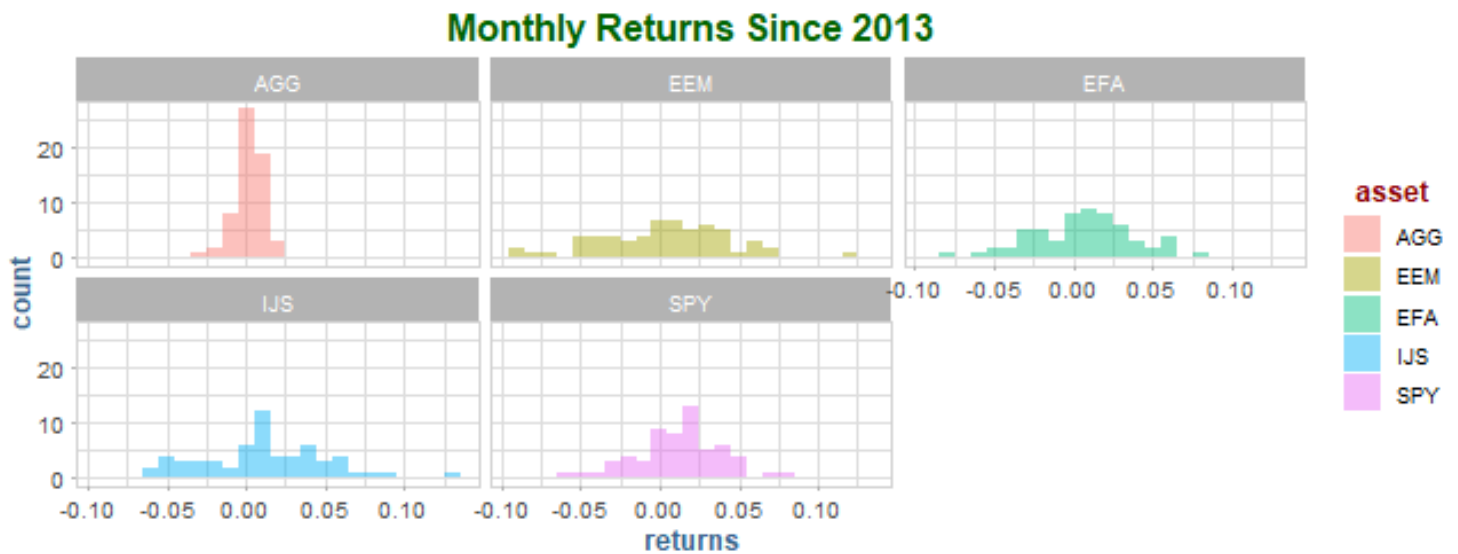
[[4]]

[[5]]

asset_returns_long %>%
  ggplot(aes(x = returns, fill = asset)) +
  geom_histogram(alpha = 0.45, binwidth = 0.005) +
  ggtitle("Monthly Returns Since 2013") +
  theme_update(plot.title = element_text(hjust = 0.5))
```

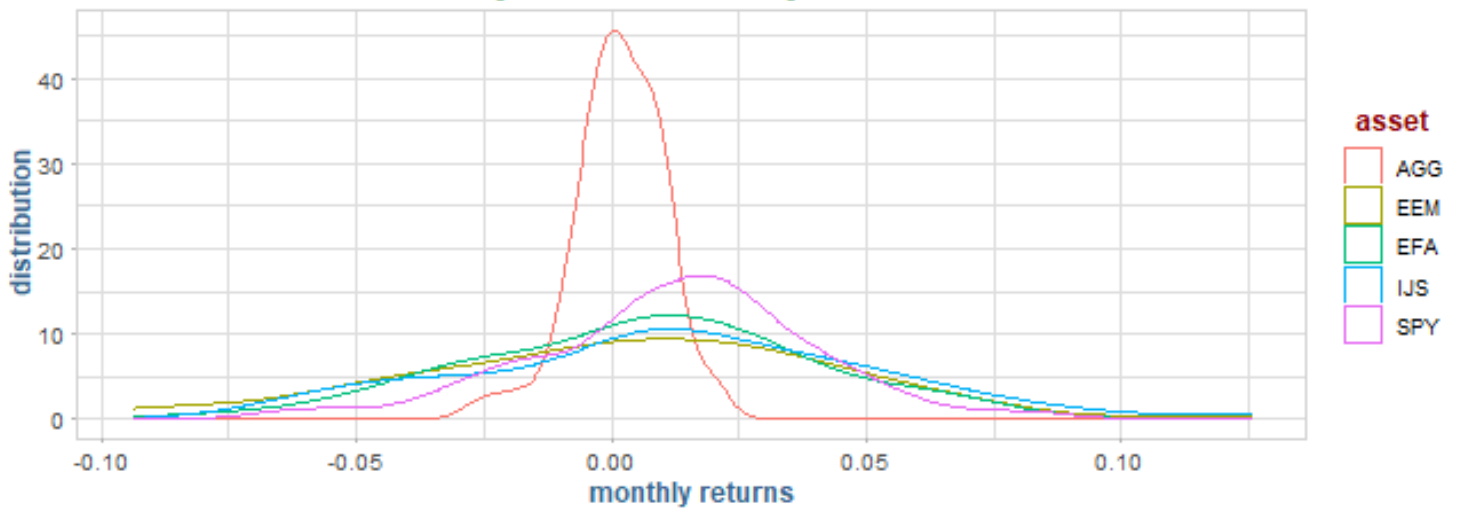


```
asset_returns_long %>%
  ggplot(aes(x = returns, fill = asset)) +
  geom_histogram(alpha = 0.45, binwidth = 0.01) +
  facet_wrap(~asset) +
  ggtitle("Monthly Returns Since 2013") +
  theme_update(plot.title = element_text(hjust = 0.5))
```



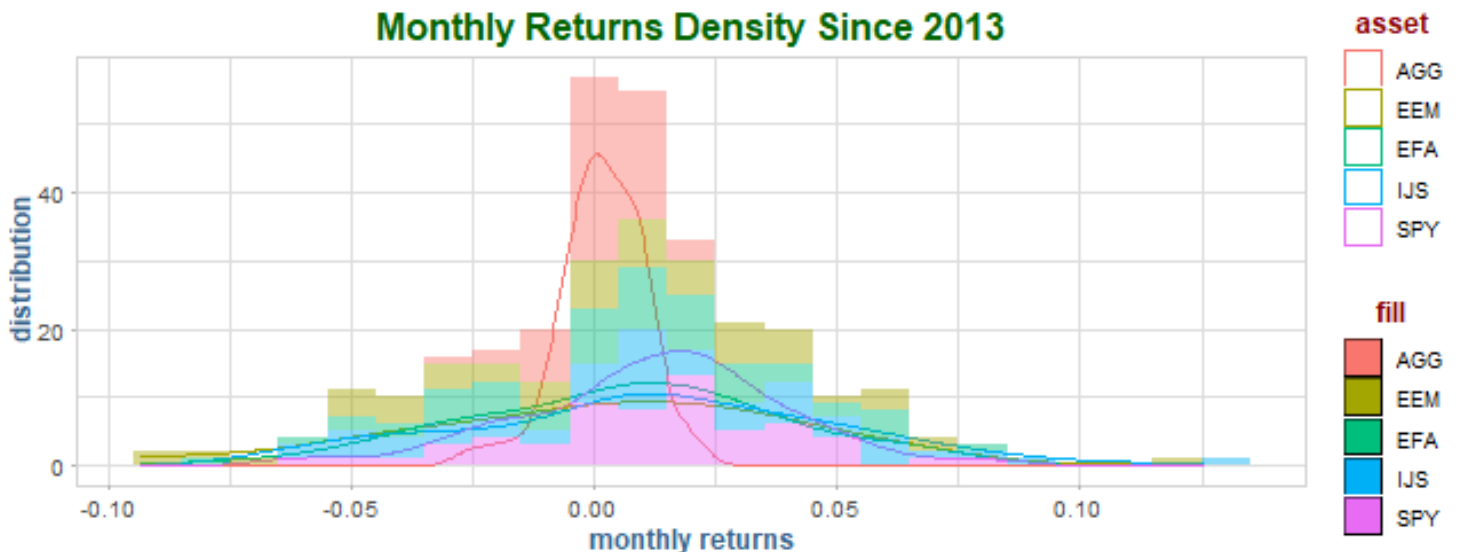
```
asset_returns_long %>%
  ggplot(aes(x = returns, colour = asset)) +
  geom_density(alpha = 1) +
  ggtitle("Monthly Returns Density Since 2013") +
  xlab("monthly returns") +
  ylab("distribution") +
  theme_update(plot.title = element_text(hjust = 0.5))
```

Monthly Returns Density Since 2013



```
asset_returns_long %>%
  ggplot(aes(x = returns)) +
  geom_density(aes(color = asset), alpha = 1) +
  geom_histogram(aes(fill = asset), alpha = 0.45, binwidth = 0.01) +
  ggtitle("Monthly Returns Density Since 2013") +
  xlab("monthly returns") +
  ylab("distribution") +
  theme_update(plot.title = element_text(hjust = 0.5))
```

Monthly Returns Density Since 2013



```
asset_returns_long %>%
  ggplot(aes(x = returns)) +
  geom_density(aes(color = asset), alpha = 1) +
```



```
geom_histogram(aes(fill = asset), alpha = 0.45, binwidth = 0.01) +  
facet_wrap(~asset) +  
ggtitle("Monthly Returns Density Since 2013") +  
xlab("monthly returns") +  
ylab("distribution") +  
theme_update(plot.title = element_text(hjust = 0.5))
```

