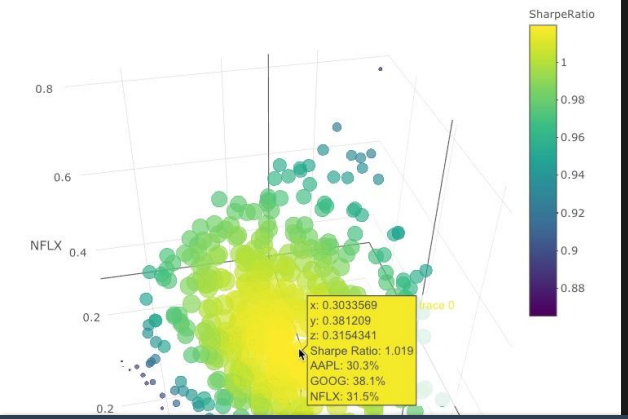



```
3  library(tidyquant)
4
5  start <- "2014-01-01" %>% ymd()
6  end   <- start + years(5) - days(1)
7
8  Ra <- c("AAPL", "GOOG", "NFLX") %>%
9      tq_get(get  = "stock.prices",
10            from = start,
```

Finance with

Performance Analysis and Portfolio Optimization using tidyquant

Matt Dancho

R/Finance 2019

About Me

- **Founder**
  (Business Science)
- **Creator**
  (tidyquant)
- **Educator**
  (I teach DS4B)

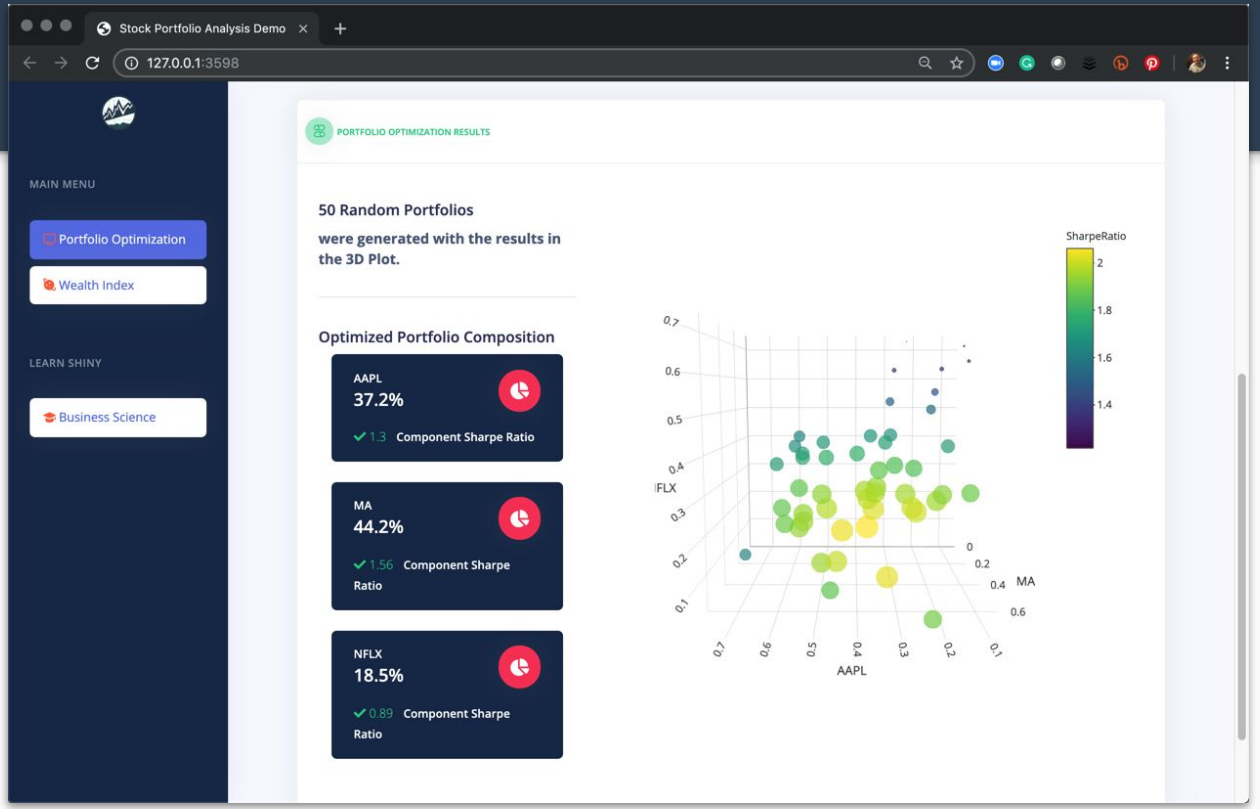
Matt Dancho

Founder of Business Science, Matt designs and executes educational courses and workshops that deliver immediate value to organizations. His passion is **up-leveling future data scientists** coming from **untraditional backgrounds**.

Demo

Portfolio Optimization App

- Shiny
- tidyquant
- argonDash

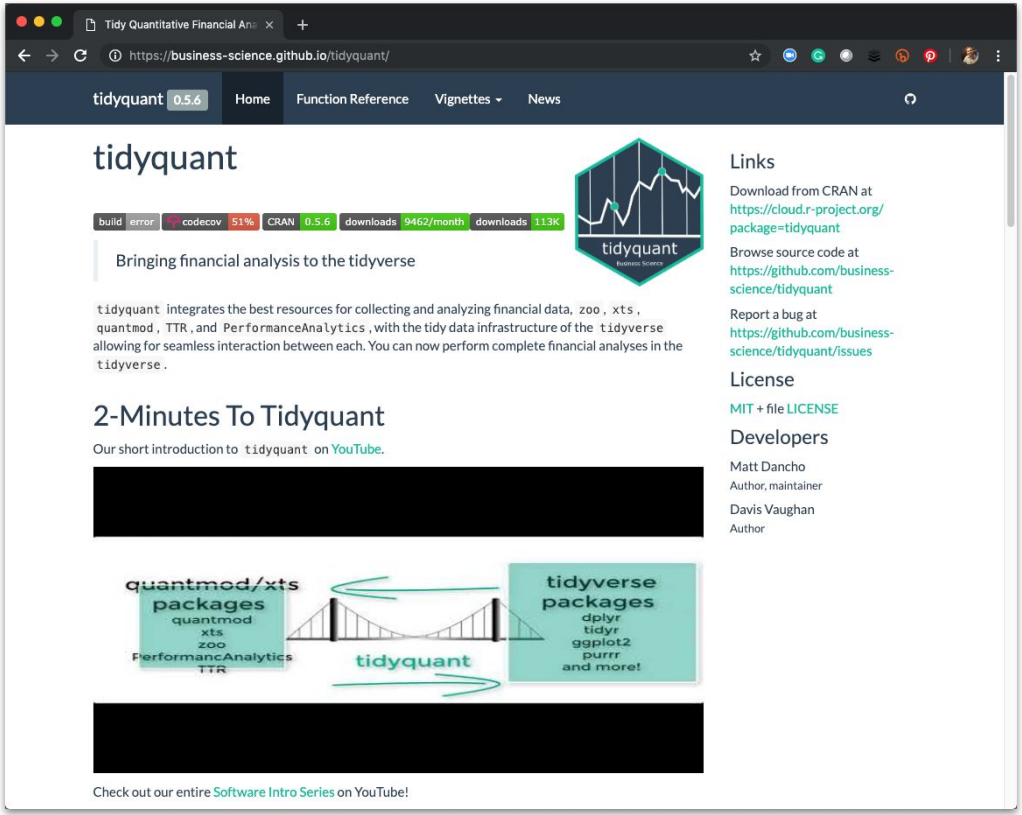


What is tidyquant?

And how do we use it?

Tidyquant

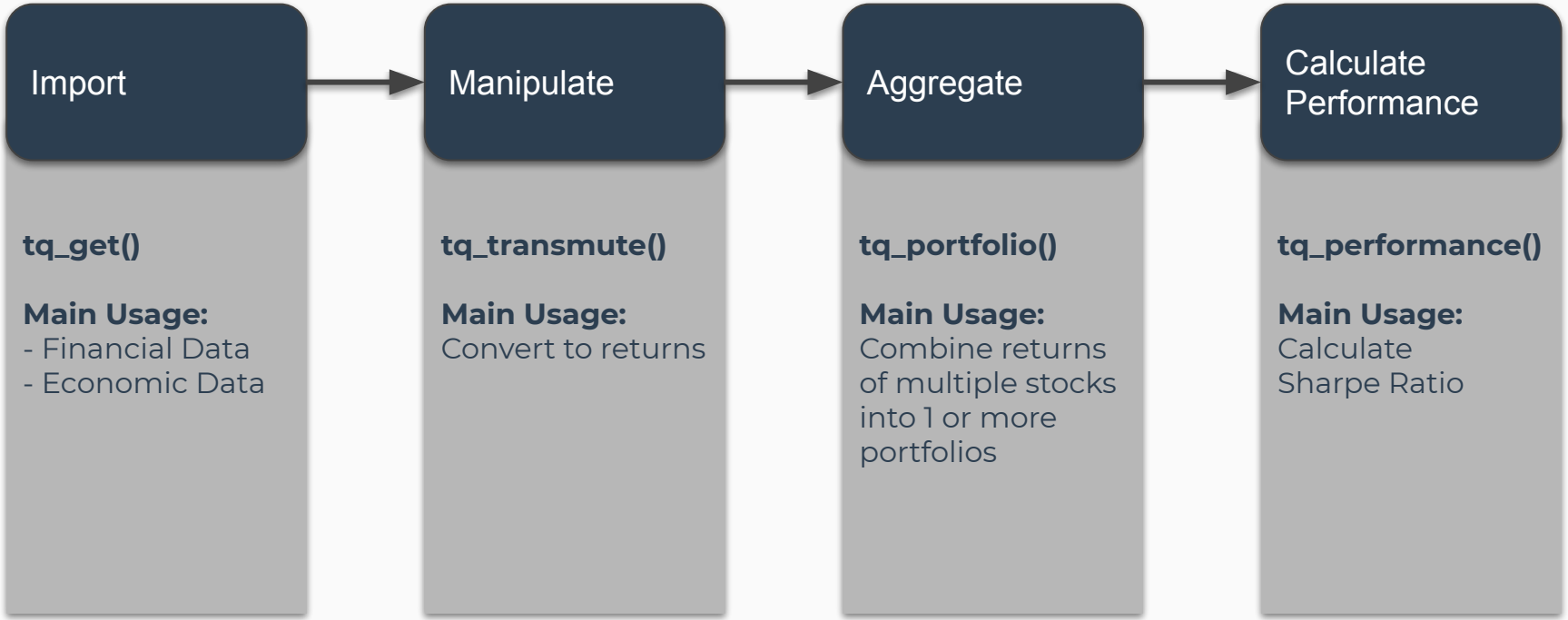
- Financial Software
- 113,000 Downloads (9,462/mo)
- Used by Many Financial Companies
- It's a Workflow



Documentation: business-science.github.io/tidyquant

Tidyquant is a workflow

API that manages the process of **systematically** evaluating stocks & portfolios



Import

Import

tq_get()

Main Usage:
- Financial Data
- Economic Data

Manipulate

tq_transmute()

Main Usage:
Convert to returns

Aggregate

tq_portfolio()

Main Usage:
Combine returns of multiple stocks into 1 or more portfolios

Calculate Performance

tq_performance()

Main Usage:
Calculate Sharpe Ratio

Get Data

```
1  library(tidyquant)
2
3  # Stock Prices
4  tq_get("AAPL", from = "2018-01-01", to = "2018-12-31")
5
6  # FRED Economic Data
7  tibble(symbol = c("MKTGDPCNA646NWDB"),
8         name   = c("GDP China")) %>%
9      tq_get(get = "economic.data", from = "1960-01-01")
10
```

Connects To

Yahoo - Bloomberg - FRED - Quandl - more!

Import

Stock Data

```
> tq_get("AAPL", from = "2018-01-01", to = "2018-12-31")
# A tibble: 250 x 7
   date        open  high   low close   volume adjusted
   <date>     <dbl> <dbl> <dbl> <dbl>    <dbl>    <dbl>
 1 2018-01-02  170.  172.  169.  172. 25555900     169.
 2 2018-01-03  173.  175.  172.  172. 29517900     169.
 3 2018-01-04  173.  173.  172.  173. 22434600     170.
 4 2018-01-05  173.  175.  173.  175  23660000     172.
 5 2018-01-08  174.  176.  174.  174. 20567800     171.
 6 2018-01-09  175.  175.  173.  174. 21584000     171.
 7 2018-01-10  173.  174.  173   174. 23959900     171.
 8 2018-01-11  175.  175.  174.  175. 18667700     172.
 9 2018-01-12  176.  177.  176.  177. 25226000     174.
10 2018-01-16  178.  179.  176.  176. 29565900     173.
# … with 240 more rows
```

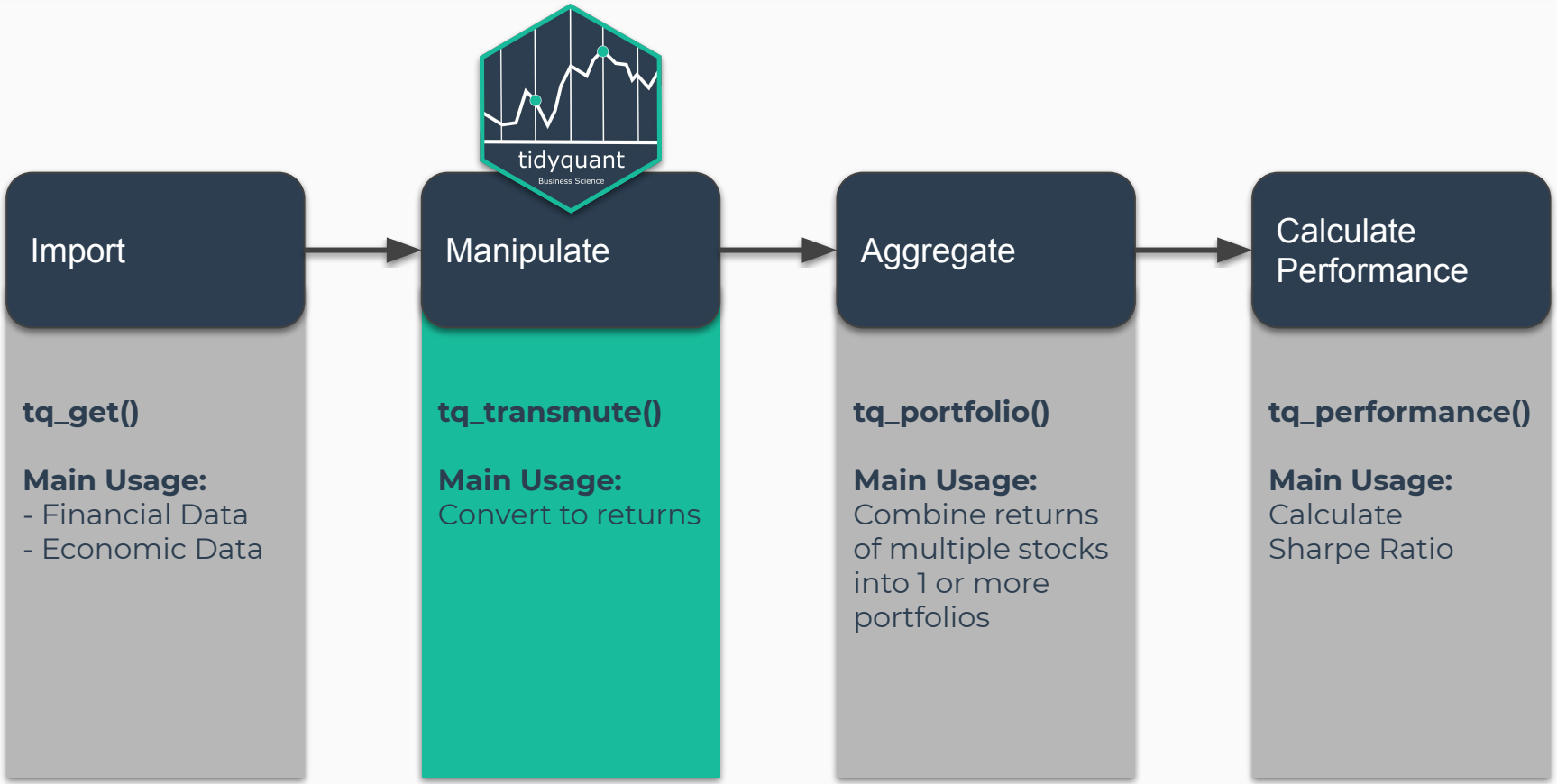
Economic Data

```
> tibble(symbol = c("MKTGDPCNA646NWDB"),
+        name   = c("GDP China")) %>%
+     tq_get(get = "economic.data", from = "1960-01-01")
# A tibble: 58 x 4
   symbol           name      date              price
   <chr>            <chr>     <date>            <dbl>
 1 MKTGDPCNA646NWDB GDP China 1960-01-01 59716467625.
 2 MKTGDPCNA646NWDB GDP China 1961-01-01 50056868958.
 3 MKTGDPCNA646NWDB GDP China 1962-01-01 47209359006.
 4 MKTGDPCNA646NWDB GDP China 1963-01-01 50706799903.
 5 MKTGDPCNA646NWDB GDP China 1964-01-01 59708343489.
 6 MKTGDPCNA646NWDB GDP China 1965-01-01 70436266147.
 7 MKTGDPCNA646NWDB GDP China 1966-01-01 76720285970.
 8 MKTGDPCNA646NWDB GDP China 1967-01-01 72881631327.
 9 MKTGDPCNA646NWDB GDP China 1968-01-01 70846535056.
10 MKTGDPCNA646NWDB GDP China 1969-01-01 79705906247.
# … with 48 more rows
```

Connects To

Yahoo - Bloomberg - FRED - Quandl - more!

Manipulate


tidyquant
Business Science
Import
Manipulate
Aggregate
Calculate Performance
tq_get()
Main Usage:
- Financial Data
- Economic Data
tq_transmute()
Main Usage:
Convert to returns
tq_portfolio()
Main Usage:
Combine returns of multiple stocks into 1 or more portfolios
tq_performance()
Main Usage:
Calculate Sharpe Ratio

Transform Financial Data to Returns

```
12  library(tidyquant)
13
14  end   <- "2018-12-31" %>% ymd()
15  start <- end - years(5) + days(1)
16
17  returns_m_components_tbl <- c("AAPL", "GOOG", "NFLX") %>%
18      tq_get(get  = "stock.prices",
19             from = start,
20             to   = end) %>%
21      group_by(symbol) %>%
22      tq_transmute(select     = adjusted,
23                   mutate_fun = periodReturn,
24                   period     = "monthly") %>%
25      ungroup()
26
27  returns_m_components_tbl
```

```
> Ra
# A tibble: 180 x 3
# Groups:   symbol [3]
   symbol date            Ra
   <chr>  <date>       <dbl>
 1 AAPL   2014-01-31 -0.0950
 2 AAPL   2014-02-28  0.0969
 3 AAPL   2014-03-31  0.0200
 4 AAPL   2014-04-30  0.0994
 5 AAPL   2014-05-30  0.116
 6 AAPL   2014-06-30  0.0277
 7 AAPL   2014-07-31  0.0287
 8 AAPL   2014-08-29  0.0775
 9 AAPL   2014-09-30 -0.0171
10 AAPL   2014-10-31  0.0720
# … with 170 more rows
```

Aggregate

Import	Manipulate	Aggregate	Calculate Performance
tq_get()	**tq_transmute()**	**tq_portfolio()**	**tq_performance()**
Main Usage: - Financial Data - Economic Data	**Main Usage:** Convert to returns	**Main Usage:** Combine returns of multiple stocks into 1 or more portfolios	**Main Usage:** Calculate Sharpe Ratio

Aggregate to Portfolio

```
28 wts_tbl <- returns_m_components_tbl %>%
29     distinct(symbol) %>%
30     mutate(weights = c(0.25, 0.25, 0.5))
31
32 wts_tbl
33
34 returns_m_portfolio_tbl <- returns_m_components_tbl %>%
35     tq_portfolio(symbol, monthly.returns,
36                  weights = wts_tbl,
37                  rebalance_on = "quarters"
38     )
```

```
> wts_tbl
# A tibble: 3 x 2
  symbol weights
  <chr>     <dbl>
1 AAPL       0.25
2 GOOG       0.25
3 NFLX       0.5
```

```
> returns_m_portfolio_tbl
# A tibble: 60 x 2
   date       portfolio.returns
   <date>                 <dbl>
 1 2014-01-31           0.0479
 2 2014-02-28           0.0656
 3 2014-03-31          -0.130
 4 2014-04-30          -0.0314
 5 2014-05-30           0.176
 6 2014-06-30           0.0416
 7 2014-07-31          -0.0147
 8 2014-08-29           0.0821
 9 2014-09-30          -0.0302
10 2014-10-31          -0.0547
# … with 50 more rows
```

Aggregate to Portfolio

```
28 wts_tbl <- returns_m_components_tbl %>%
29     distinct(symbol) %>%
30     mutate(weights = c(0.25, 0.25, 0.5))
31
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1 AAPL       0.25
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```

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 4 2014-04-30           -0.0314
 5 2014-05-30            0.176
 6 2014-06-30            0.0416
 7 2014-07-31           -0.0147
 8 2014-08-29            0.0821
 9 2014-09-30           -0.0302
10 2014-10-31           -0.0547
# … with 50 more rows
```

Aggregate to Portfolio

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28  wts_tbl <- returns_m_components_tbl %>%
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32  wts_tbl
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1 AAPL       0.25
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```

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   date       portfolio.returns
   <date>                 <dbl>
 1 2014-01-31           0.0479
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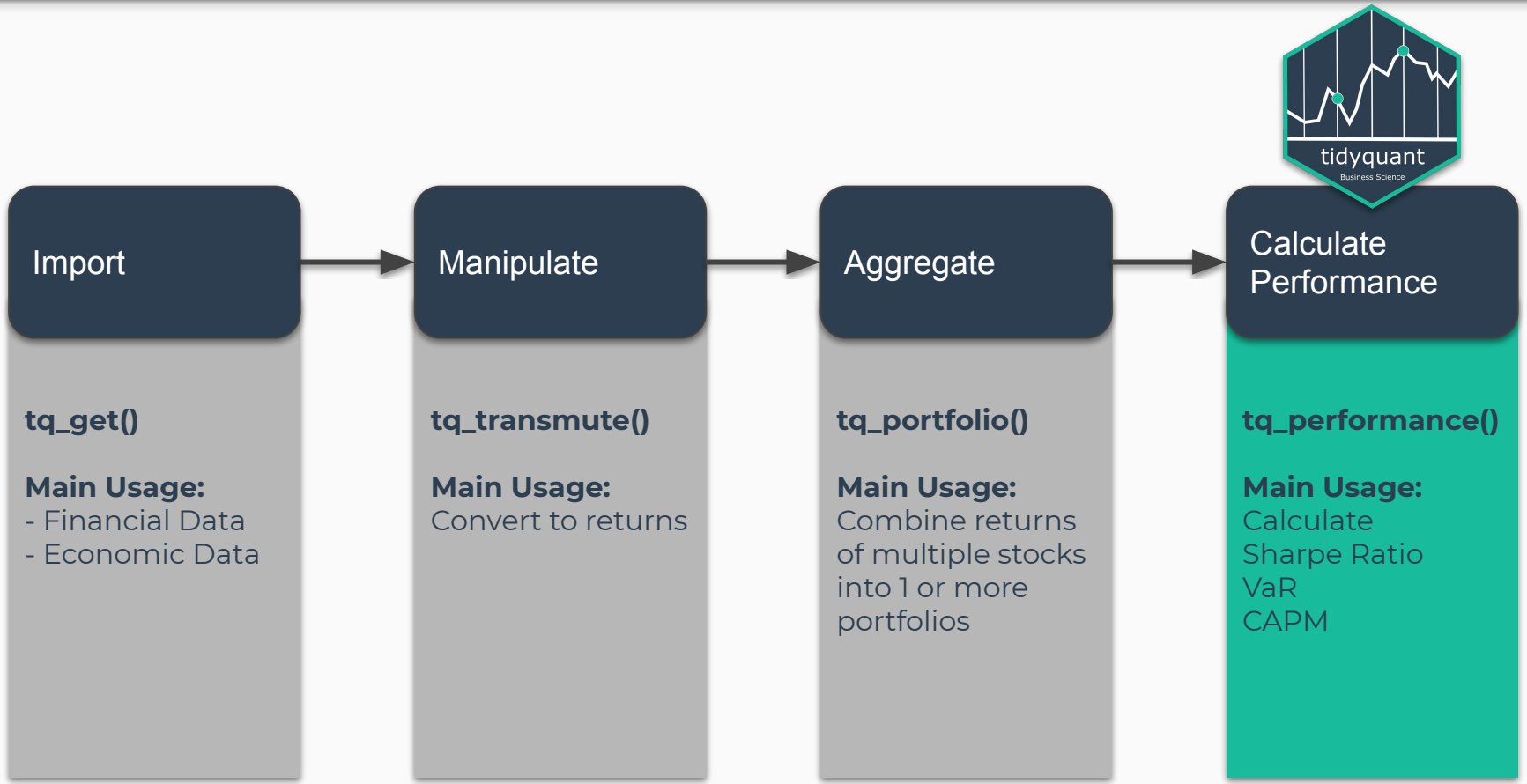
 4 2014-04-30          -0.0314
 5 2014-05-30           0.176
 6 2014-06-30           0.0416
 7 2014-07-31          -0.0147
 8 2014-08-29           0.0821
 9 2014-09-30          -0.0302
10 2014-10-31          -0.0547
# … with 50 more rows
```

Calculate Performance



Measure Sharpe Ratio

```
93  returns_m_portfolio_merged_m_tbl <- returns_m_portfolio_tbl %>%
94      add_column(symbol = "Portfolio", .before = 1) %>%
95      bind_rows(returns_m_benchmark_tbl)
96
97  returns_m_portfolio_merged_m_tbl %>%
98      group_by(symbol) %>%
99      tq_performance(Ra = monthly.returns,
100                    performance_fun = SharpeRatio.annualized,
101                    scale = 12)
102
```

```
# A tibble: 2 x 2
# Groups:   symbol [2]
  symbol    `AnnualizedSharpeRatio(Rf=0%)`
  <chr>                              <dbl>
1 Portfolio                          1.02
2 XLK                                0.984
```

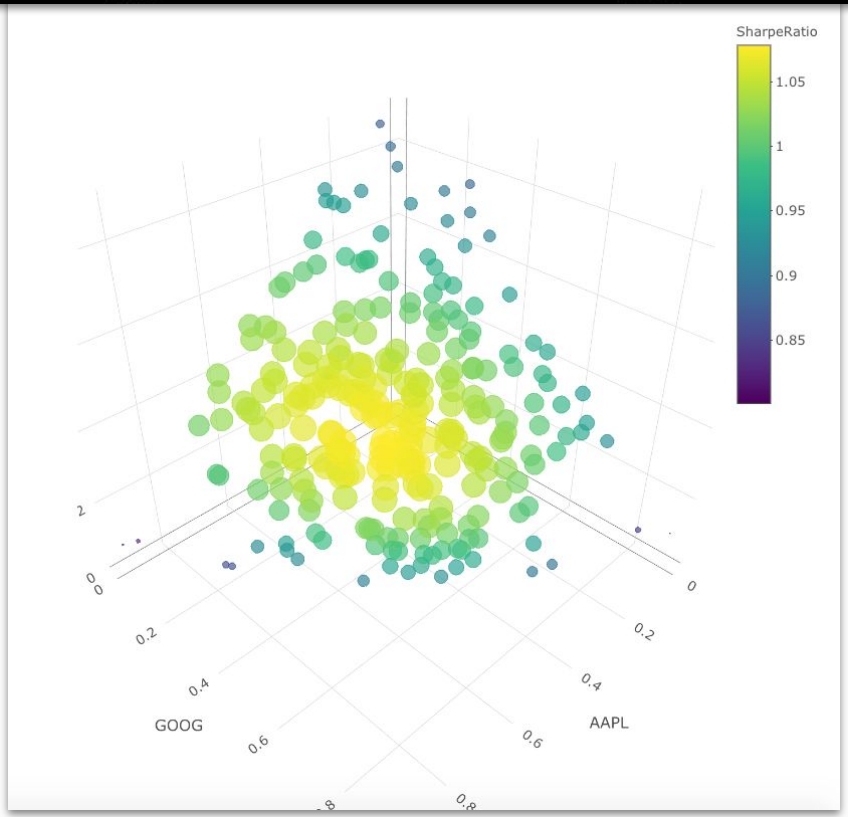
Optimize Performance

Iterate 50X+

Measure Sharpe Ratio

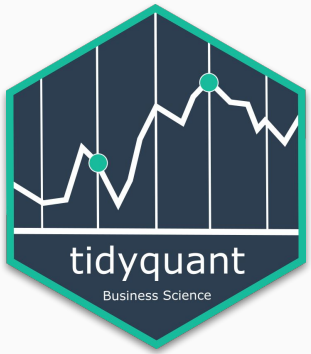
Pick Best Portfolio

```
> best_portfolio_tbl %>%
+     select(portfolio_id, `AnnualizedSharpeRatio(Rf=0%)`)
# A tibble: 1 x 2
  portfolio_id `AnnualizedSharpeRatio(Rf=0%)`
         <int>                          <dbl>
1          124                           1.08
```



30-Second Recap

Tidyquant: Financial Analysis Workflow



API that manages the process of systematically evaluating stocks & portfolios

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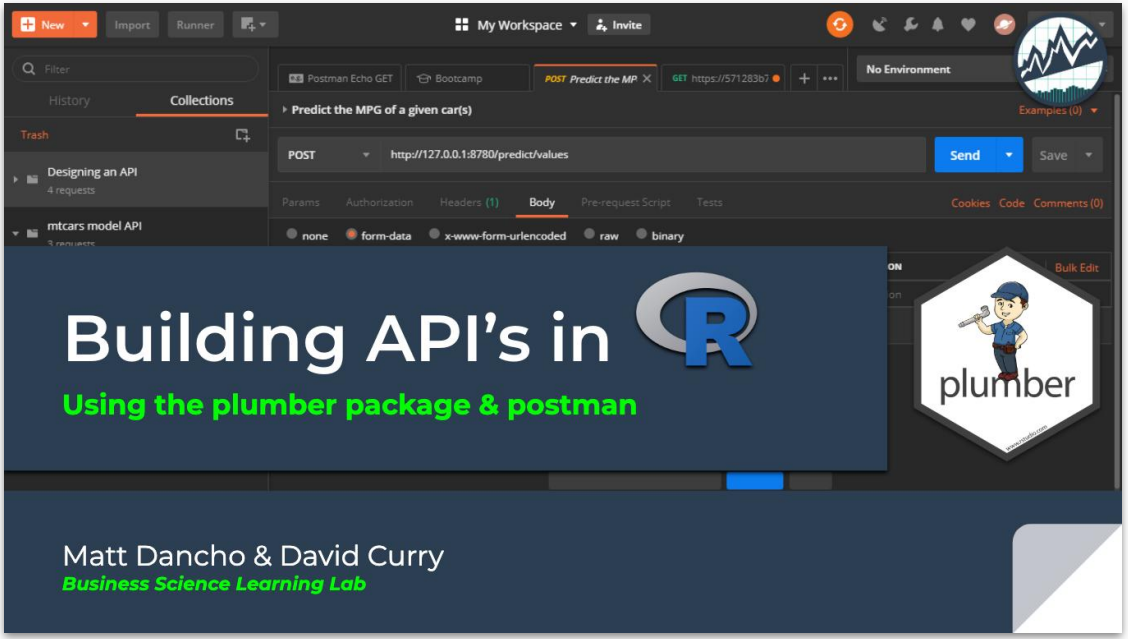
Plumber R Package

Live Event - Learning Lab (It's Free)



Register Here: bit.ly/learning-lab-plumber