Criando um portfólio de ações com o CAPM

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Introdução

Este projeto tem por objetivo construir um portfólio de ações da bolsa brasileira, utilizando como base teórica o CAPM - Capital Asset Pricing Model.

Para desenvolver esse exercício, estou usando o pacote Tidyquant, disponível em:

https://cran.r-project.org/web/packages/tidyquant/vignettes/TQ05-performance-analysis-with-tidyquant.html

```
setwd("C:/Users/vande/OneDrive/Documentos/R/basico")
getwd()
```

```
## [1] "C:/Users/vande/OneDrive/Documentos/R/basico"
```

Construindo um portfólio de investimentos com o modelo CAPM, com dados outubro/2021

Habilitando os pacotes

```
library(tidyquant)

library(PerformanceAnalytics)
library(tidyverse)
```

Construindo os vetores dos papeis e seus respectivos pesos

```
acoes_v <- c("M1RN34.SA", "NVDC34.SA", "TSLA34.SA", "NFLX34.SA", "MSFT34.
SA", "NIKE34.SA", "ADBE34.SA", "GOGL34.SA", "HOME34.SA", "PFIZ34.SA", "AA
PL34.SA", "IVVB11.SA", "SPXI11.SA", "PARD3.SA", "ABEV3.SA", "MDIA3.SA", "
COCA34.SA", "BOVA11.SA", "AMER3.SA", "VALE3.SA")
vetor_peso <- c(0.16, 0.13, 0.12, 0.07, 0.06, 0.06, 0.05, 0.05, 0.04, 0.0
4, 0.03, 0.03, 0.02, 0.02, 0.02, 0.02, 0.02, 0.02, 0.02, 0.02)
sum(vetor_peso)
```

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

```
acoes_df <- tq_get(c(acoes_v),
       get = "stock.prices",
       from = "2021-10-01",
       to = "2021-10-31") %>%
       group_by(symbol)
```

```
head(acoes_df)
```

```
## # A tibble: 6 x 8
## # Groups:   symbol [1]
##   symbol    date        open  high   low close volume adjusted
##   <chr>     <date>     <dbl> <dbl> <dbl> <dbl>  <dbl>    <dbl>
## 1 M1RN34.SA 2021-10-01  198.  198.  174.  184. 179986     184.
## 2 M1RN34.SA 2021-10-04  174.  179.  166.  177. 145401     177.
## 3 M1RN34.SA 2021-10-05  179.  184.  179.  182.  48985     182.
## 4 M1RN34.SA 2021-10-06  177.  179.  165.  165.  62911     165.
## 5 M1RN34.SA 2021-10-07  165.  174.  162.  170.  59779     170.
## 6 M1RN34.SA 2021-10-08  173.  173.  165.  167.  38179     167.
```

Calculando o retorno diário

```
ret_acoes <- acoes_df %>%
  tq_transmute(select = adjusted,
               mutate_fun = periodReturn,
               period = 'daily',
               col_rename = 'ret')

ret_acoes
```

```
## # A tibble: 400 x 3
## # Groups:   symbol [20]
##    symbol    date           ret
##    <chr>     <date>       <dbl>
##  1 M1RN34.SA 2021-10-01  0
##  2 M1RN34.SA 2021-10-04 -0.0334
##  3 M1RN34.SA 2021-10-05  0.0272
##  4 M1RN34.SA 2021-10-06 -0.0945
##  5 M1RN34.SA 2021-10-07  0.0316
##  6 M1RN34.SA 2021-10-08 -0.0173
##  7 M1RN34.SA 2021-10-11  0.0132
##  8 M1RN34.SA 2021-10-13  0.0446
##  9 M1RN34.SA 2021-10-14  0.0339
## 10 M1RN34.SA 2021-10-15 -0.0404
## # ... with 390 more rows
```

Juntar a série de retornos ao portfólio

```
retornos_diarios_portfolio <- ret_acoes %>%
  tq_portfolio(assets_col = symbol,
               returns_col = ret,
               weights = vetor_peso,
               col_rename = "Ra")
```

```
retornos_diarios_portfolio
```

```
## # A tibble: 20 x 2
##    date             Ra
##    <date>        <dbl>
##  1 2021-10-01  0
##  2 2021-10-04 -0.00839
##  3 2021-10-05  0.0235
##  4 2021-10-06 -0.0101
##  5 2021-10-07  0.0196
##  6 2021-10-08 -0.00313
##  7 2021-10-11  0.00337
##  8 2021-10-13  0.0121
##  9 2021-10-14  0.0173
## 10 2021-10-15 -0.00547
## 11 2021-10-18  0.0265
## 12 2021-10-19  0.0135
## 13 2021-10-20 -0.0108
## 14 2021-10-21  0.0317
## 15 2021-10-22 -0.00881
## 16 2021-10-25  0.0227
## 17 2021-10-26  0.00538
## 18 2021-10-27  0.00552
## 19 2021-10-28  0.0200
## 20 2021-10-29  0.0176
```

Comparar o retorno com o benchmark (Ibovespa)

```
tq_get("^BVSP")
```

```
## # A tibble: 2,687 x 8
##    symbol date        open  high   low close  volume adjusted
##    <chr>  <date>     <dbl> <dbl> <dbl> <dbl>   <dbl>    <dbl>
##  1 ^BVSP  2011-01-03 69310 70471 69305 69962 1862400    69962
##  2 ^BVSP  2011-01-04 69962 70318 69560 70318 2427200    70318
##  3 ^BVSP  2011-01-05 70311 71173 69802 71091 2309200    71091
##  4 ^BVSP  2011-01-06 71093 71167 70469 70579 2546000    70579
##  5 ^BVSP  2011-01-07 70580 70783 69718 70057 1761000    70057
##  6 ^BVSP  2011-01-10 70056 70133 69666 70127 1610800    70127
##  7 ^BVSP  2011-01-11 70146 70647 70145 70423 2138000    70423
##  8 ^BVSP  2011-01-12 70429 71633 70429 71633 2516000    71633
##  9 ^BVSP  2011-01-13 71631 71924 70719 70721 2237800    70721
## 10 ^BVSP  2011-01-14 70723 71184 70397 70940 1806600    70940
## # ... with 2,677 more rows
```

```
ibov_df <- tq_get(c("^BVSP"),
                  get = "stock.prices",
                  from = "2021-10-01",
                  to = "2021-10-31") %>%
                  group_by(symbol)
```

```
ibov_df
```

```
## # A tibble: 20 x 8
## # Groups:   symbol [1]
##    symbol date         open   high    low  close   volume adjusted
##    <chr>  <date>      <dbl>  <dbl>  <dbl>  <dbl>    <dbl>    <dbl>
##  1 ^BVSP  2021-10-01 110980 113020 110980 112900 10779100   112900
##  2 ^BVSP  2021-10-04 112900 112900 109979 110393 11814200   110393
##  3 ^BVSP  2021-10-05 110397 111691 110087 110458 10379000   110458
##  4 ^BVSP  2021-10-06 110454 110614 108180 110560 13279200   110560
##  5 ^BVSP  2021-10-07 110563 111522 110563 110585 10646000   110585
##  6 ^BVSP  2021-10-08 110586 114172 110586 112833 12871400   112833
##  7 ^BVSP  2021-10-11 112834 113982 112052 112180 10283700   112180
##  8 ^BVSP  2021-10-13 112180 114159 111807 113456 11732700   113456
##  9 ^BVSP  2021-10-14 113457 113881 112708 113185  8956200   113185
## 10 ^BVSP  2021-10-15 113189 114776 113049 114648 11174900   114648
## 11 ^BVSP  2021-10-18 114647 114927 112841 114428 11201300   114428
## 12 ^BVSP  2021-10-19 114422 114422 109947 110673 14129200   110673
## 13 ^BVSP  2021-10-20 110677 112023 110176 110786 11735800   110786
## 14 ^BVSP  2021-10-21 110767 110767 105714 107735 16507700   107735
## 15 ^BVSP  2021-10-22 107714 107749 102854 106296 21165700   106296
## 16 ^BVSP  2021-10-25 106298 109372 106296 108715 11512100   108715
## 17 ^BVSP  2021-10-26 108713 108713 106321 106420 10762200   106420
## 18 ^BVSP  2021-10-27 106433 108224 106045 106363 10831300   106363
## 19 ^BVSP  2021-10-28 106369 107210 105282 105705 11502900   105705
## 20 ^BVSP  2021-10-29 105707 105954 103430 103501 12595800   103501
```

```
ret_ibov <- ibov_df %>%
  tq_transmute(select = adjusted,
               mutate_fun = periodReturn,
               period = 'daily',
               col_rename = 'Rm')
```

```
ret_ibov
```

```
## # A tibble: 20 x 3
## # Groups:   symbol [1]
##    symbol date              Rm
##    <chr>  <date>         <dbl>
##  1 ^BVSP  2021-10-01  0
##  2 ^BVSP  2021-10-04 -0.0222
##  3 ^BVSP  2021-10-05  0.000589
##  4 ^BVSP  2021-10-06  0.000923
##  5 ^BVSP  2021-10-07  0.000226
##  6 ^BVSP  2021-10-08  0.0203
##  7 ^BVSP  2021-10-11 -0.00579
##  8 ^BVSP  2021-10-13  0.0114
##  9 ^BVSP  2021-10-14 -0.00239
## 10 ^BVSP  2021-10-15  0.0129
## 11 ^BVSP  2021-10-18 -0.00192
## 12 ^BVSP  2021-10-19 -0.0328
```

```
## 13 ^BVSP  2021-10-20  0.00102
## 14 ^BVSP  2021-10-21 -0.0275
## 15 ^BVSP  2021-10-22 -0.0134
## 16 ^BVSP  2021-10-25  0.0228
## 17 ^BVSP  2021-10-26 -0.0211
## 18 ^BVSP  2021-10-27 -0.000536
## 19 ^BVSP  2021-10-28 -0.00619
## 20 ^BVSP  2021-10-29 -0.0209
```

```
retornos_diarios_ibov <- ret_ibov[,-1]
retornos_diarios_ibov
```

```
## # A tibble: 20 x 2
##    date              Rm
##    <date>         <dbl>
##  1 2021-10-01  0
##  2 2021-10-04 -0.0222
##  3 2021-10-05  0.000589
##  4 2021-10-06  0.000923
##  5 2021-10-07  0.000226
##  6 2021-10-08  0.0203
##  7 2021-10-11 -0.00579
##  8 2021-10-13  0.0114
##  9 2021-10-14 -0.00239
## 10 2021-10-15  0.0129
## 11 2021-10-18 -0.00192
## 12 2021-10-19 -0.0328
## 13 2021-10-20  0.00102
## 14 2021-10-21 -0.0275
## 15 2021-10-22 -0.0134
## 16 2021-10-25  0.0228
## 17 2021-10-26 -0.0211
## 18 2021-10-27 -0.000536
## 19 2021-10-28 -0.00619
## 20 2021-10-29 -0.0209
```

Calculando a performance

```
df_portfolio_perf <- left_join(retornos_diarios_portfolio,
                               retornos_diarios_ibov,
                               by = "date")

df_portfolio_perf
```

```
## # A tibble: 20 x 3
##    date              Ra        Rm
##    <date>         <dbl>     <dbl>
##  1 2021-10-01  0        0
##  2 2021-10-04 -0.00839 -0.0222
##  3 2021-10-05  0.0235   0.000589
##  4 2021-10-06 -0.0101   0.000923
```

```
##  5 2021-10-07  0.0196   0.000226
##  6 2021-10-08 -0.00313  0.0203
##  7 2021-10-11  0.00337 -0.00579
##  8 2021-10-13  0.0121   0.0114
##  9 2021-10-14  0.0173  -0.00239
## 10 2021-10-15 -0.00547  0.0129
## 11 2021-10-18  0.0265  -0.00192
## 12 2021-10-19  0.0135  -0.0328
## 13 2021-10-20 -0.0108   0.00102
## 14 2021-10-21  0.0317  -0.0275
## 15 2021-10-22 -0.00881 -0.0134
## 16 2021-10-25  0.0227   0.0228
## 17 2021-10-26  0.00538 -0.0211
## 18 2021-10-27  0.00552 -0.000536
## 19 2021-10-28  0.0200  -0.00619
## 20 2021-10-29  0.0176  -0.0209
```

Obtendo o CAPM

```
capm <- tq_performance(df_portfolio_perf, Ra, Rm, performance_fun = table
.CAPM)
View(capm)
```

Obtendo o índice de Sharpe do portfólio

```
tq_performance(df_portfolio_perf, Ra = Ra, Rb = NULL, performance_fun = S
harpeRatio)
```

```
## # A tibble: 1 x 3
##   `ESSharpe(Rf=0%,p=95%)` `StdDevSharpe(Rf=0%,p=95%)` `VaRSharpe(Rf=0%
,p=95%)`
##                     <dbl>                       <dbl>
<dbl>
## 1                   0.545                       0.635
0.635
```

Retorno anualizado do portfólio

```
teste <- df_portfolio_perf[-1,]
tq_performance(teste, Ra = Ra, Rb = NULL, performance_fun = table.Annuali
zedReturns)
```

```
## # A tibble: 1 x 3
##   AnnualizedReturn `AnnualizedSharpe(Rf=0%)` AnnualizedStdDev
##              <dbl>                     <dbl>            <dbl>
## 1             8.49                      38.8            0.219
```

Evolução do patrimônio supondo patrimônio inicial de R$ 100.000,00

```
retorno_port <- ret_acoes %>%
  tq_portfolio(assets_col = symbol,
               returns_col = ret,
               weights = vetor_peso,
               col_rename = "crescimento.portfolio",
```

```
                wealth.index = TRUE) %>%
  mutate(crescimento.portfolio * 100000)

ggplot(data = retorno_port, aes(x = date, y = crescimento.portfolio)) +
  geom_line(size = 1) +
  labs(title = "Evolução de R$ 100.000 investidos no portfólio com o temp
o",
       caption = "Dados do Yahoo Finance",
       x = "", y = "PL")
```