Joao_estimacao_4-plm–v4-.R

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```
# justa diretorio de trabalho
setwd("C:/Users/Teo/Downloads")

# limpeza das variaveis de ambiente
rm(list = ls())

# lista de bibliotecas utilizadas
library(readxl)
library(dplyr)
```

```
##
## Attaching package: 'dplyr'
```

```
## The following objects are masked from 'package:stats':
##
##     filter, lag
```

```
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
library(magrittr)
library(ggplot2)
library(plm)
```

```
##
## Attaching package: 'plm'
```

```
## The following objects are masked from 'package:dplyr':
##
##     between, lag, lead
```

```
#  leitura da base de dados
tbl <- read_excel("TabelaFinal_corrigido.xlsx", sheet = "Sheet 1")

# cria funcao que tira a diferenca do log
d.ln <- function(x) { return(log(x)-lag(log(x)))}

tbl
```

```
## # A tibble: 2,667 × 24
##    Ação     Ano Trail…¹ Cap E…² Retur…³ Tobin…⁴ Total …⁵ Total…⁶ Norma…⁷ Long …⁸
##    <chr>  <dbl>   <dbl>   <dbl>   <dbl>   <dbl>    <dbl>   <dbl>   <dbl>   <dbl>
##  1 ABEV3…  1993    NA      NA        NA      NA       NA        NA      NA      NA
##  2 ABEV3…  1994    NA      NA        NA      NA       NA        NA      NA      NA
##  3 ABEV3…  1995    NA      NA        NA      NA       NA        NA      NA      NA
##  4 ABEV3…  1996    NA      NA        NA      NA       NA        NA      NA      NA
##  5 ABEV3…  1997    NA      NA        NA      NA       NA        NA      NA      NA
##  6 ABEV3…  1998    NA      NA        NA      NA        0.01     0       NA      50
##  7 ABEV3…  1999    15.5    95.5      NA       1.15  9121.      39.4     NA      64.7
##  8 ABEV3…  2000    22.6     3.03     NA       2.75  8640.      25.4     NA      68.9
##  9 ABEV3…  2001    28.3     4.54     16.6     2.36 11029.      41.4     66.9    57.5
## 10 ABEV3…  2002    36.3     4.46     16.6     2.35 12381.      36.2     92.5    54.8
## # … with 2,657 more rows, 14 more variables: `ESG Disclosure Score` <dbl>,
## #   `Environmental Disclosure Score` <dbl>,
## #   `Governance Disclosure Score` <dbl>, `Social Disclosure Score` <dbl>,
## #   EBIT <dbl>, `Revenue Growth Year over Year` <dbl>,
## #   `Revenue Adjusted` <dbl>, `Number Of Trades` <dbl>,
## #   `Volatility 360 Day` <dbl>, `BESG ESG Score` <dbl>, `Risk Premium` <dbl>,
## #   `Applied Beta for EQRP` <dbl>, `Last Price` <dbl>, …
```

```
# shortcut <- (alt -)
# filtra os dados com o ano atual
tbl <- tbl %>% filter(Ano != "Atual") %>% mutate(Ano = as.numeric(Ano))

tbl
```


```
## # A tibble: 2,667 × 24
##    Ação     Ano Trail…¹ Cap E…² Retur…³ Tobin…⁴ Total …⁵ Total…⁶ Norma…⁷ Long …⁸
##    <chr>  <dbl>   <dbl>   <dbl>   <dbl>   <dbl>    <dbl>   <dbl>   <dbl>   <dbl>
##  1 ABEV3…  1993    NA      NA        NA      NA       NA        NA      NA      NA
##  2 ABEV3…  1994    NA      NA        NA      NA       NA        NA      NA      NA
##  3 ABEV3…  1995    NA      NA        NA      NA       NA        NA      NA      NA
##  4 ABEV3…  1996    NA      NA        NA      NA       NA        NA      NA      NA
##  5 ABEV3…  1997    NA      NA        NA      NA       NA        NA      NA      NA
##  6 ABEV3…  1998    NA      NA        NA      NA        0.01     0       NA      50
##  7 ABEV3…  1999    15.5    95.5      NA       1.15  9121.      39.4     NA      64.7
##  8 ABEV3…  2000    22.6     3.03     NA       2.75  8640.      25.4     NA      68.9
##  9 ABEV3…  2001    28.3     4.54     16.6     2.36 11029.      41.4     66.9    57.5
## 10 ABEV3…  2002    36.3     4.46     16.6     2.35 12381.      36.2     92.5    54.8
## # … with 2,657 more rows, 14 more variables: `ESG Disclosure Score` <dbl>,
## #   `Environmental Disclosure Score` <dbl>,
## #   `Governance Disclosure Score` <dbl>, `Social Disclosure Score` <dbl>,
## #   EBIT <dbl>, `Revenue Growth Year over Year` <dbl>,
## #   `Revenue Adjusted` <dbl>, `Number Of Trades` <dbl>,
## #   `Volatility 360 Day` <dbl>, `BESG ESG Score` <dbl>, `Risk Premium` <dbl>,
## #   `Applied Beta for EQRP` <dbl>, `Last Price` <dbl>, …
```


```
colnames(tbl)
```

```
##  [1] "Ação"                            "Ano"
##  [3] "Trailing 12M EBITDA Margin"      "Cap Expend to Tot Assets"
##  [5] "Return on Invested Capital"      "Tobin's Q Ratio"
##  [7] "Total Assets"                    "Total Debt to Total Assets"
##  [9] "Normalized Net Income Growth"    "Long Term Assets as % Total Assets"
## [11] "ESG Disclosure Score"            "Environmental Disclosure Score"
## [13] "Governance Disclosure Score"     "Social Disclosure Score"
## [15] "EBIT"                            "Revenue Growth Year over Year"
## [17] "Revenue Adjusted"                "Number Of Trades"
## [19] "Volatility 360 Day"              "BESG ESG Score"
## [21] "Risk Premium"                    "Applied Beta for EQRP"
## [23] "Last Price"                      "VWAP (Standar Deviation)"
```

```
# ajusta nome das colunas.
# retira caracteres estranhos dos nomes das colunas
colnames(tbl) <- stringr::str_replace_all(string = colnames(tbl), pattern = "[ '%]", replacem
ent = "_")
colnames(tbl) <- stringr::str_replace_all(string = colnames(tbl), pattern = "ç", replacement
= "c")
colnames(tbl) <- stringr::str_replace_all(string = colnames(tbl), pattern = "ã", replacement
= "a")
# Determinantes do ESG

colnames(tbl)
```

```
##  [1] "Acao"                            "Ano"
##  [3] "Trailing_12M_EBITDA_Margin"      "Cap_Expend_to_Tot_Assets"
##  [5] "Return_on_Invested_Capital"      "Tobin_s_Q_Ratio"
##  [7] "Total_Assets"                    "Total_Debt_to_Total_Assets"
##  [9] "Normalized_Net_Income_Growth"    "Long_Term_Assets_as___Total_Assets"
## [11] "ESG_Disclosure_Score"            "Environmental_Disclosure_Score"
## [13] "Governance_Disclosure_Score"     "Social_Disclosure_Score"
## [15] "EBIT"                            "Revenue_Growth_Year_over_Year"
## [17] "Revenue_Adjusted"                "Number_Of_Trades"
## [19] "Volatility_360_Day"              "BESG_ESG_Score"
## [21] "Risk_Premium"                    "Applied_Beta_for_EQRP"
## [23] "Last_Price"                      "VWAP_(Standar_Deviation)"
```

```r
# passando o log nas colunas "Total_Assets", "Number_Of_Trades"
tbl <- tbl %>% mutate_at(.vars = c("Total_Assets", "Number_Of_Trades"), .funs = log)

# remove as acoes de prio de anos anteriores a 2014
tbl <- tbl %>%
  filter(!(Acao == "PRIO3" & Ano <= 2014))  # eliminar PRIO antes de 2014



# eliminar ESG ausentes
tbl <- tbl %>%
  filter(!(is.na(ESG_Disclosure_Score)))





# Analise de integridade ---------------------------------------------------

tbl %>%
  count(Acao, Ano) %>%
  arrange(-n) %>% print(n=20)
```

```
## # A tibble: 1,059 × 3
##    Acao              Ano     n
##    <chr>           <dbl> <int>
##  1 ABEV3 BS Equity  2007     1
##  2 ABEV3 BS Equity  2008     1
##  3 ABEV3 BS Equity  2009     1
##  4 ABEV3 BS Equity  2010     1
##  5 ABEV3 BS Equity  2011     1
##  6 ABEV3 BS Equity  2012     1
##  7 ABEV3 BS Equity  2013     1
##  8 ABEV3 BS Equity  2014     1
##  9 ABEV3 BS Equity  2015     1
## 10 ABEV3 BS Equity  2016     1
## 11 ABEV3 BS Equity  2017     1
## 12 ABEV3 BS Equity  2018     1
## 13 ABEV3 BS Equity  2019     1
## 14 ABEV3 BS Equity  2020     1
## 15 ABEV3 BS Equity  2021     1
## 16 ABEV3 BS Equity  2022     1
## 17 ALPA4 BS Equity  2005     1
## 18 ALPA4 BS Equity  2006     1
## 19 ALPA4 BS Equity  2007     1
## 20 ALPA4 BS Equity  2008     1
## # … with 1,039 more rows
```

```r
# analise de colinearidade ------------------------------------------------

regressores <- "Trailing_12M_EBITDA_Margin +
              Cap_Expend_to_Tot_Assets +
              Return_on_Invested_Capital +
              Tobin_s_Q_Ratio +
              Total_Assets +
              Total_Debt_to_Total_Assets +
              Normalized_Net_Income_Growth +
              Revenue_Growth_Year_over_Year +
              Number_Of_Trades +
              Long_Term_Assets_as___Total_Assets +
              Volatility_360_Day"

f <- formula(paste("ESG_Disclosure_Score ~", regressores))

# Efeitos fixos
fixed <- plm(formula = f,
             data = tbl,
             index = c("Acao", "Ano"),
             model="within")
summary(fixed)
```

```
## Oneway (individual) effect Within Model
##
## Call:
## plm(formula = f, data = tbl, model = "within", index = c("Acao",
##     "Ano"))
##
## Unbalanced Panel: n = 73, T = 1-10, N = 620
##
## Residuals:
##      Min.   1st Qu.    Median   3rd Qu.      Max.
## -18.41914  -2.48358   0.01659   2.61642  14.28000
##
## Coefficients:
##                                      Estimate  Std. Error t-value  Pr(>|t|)
## Trailing_12M_EBITDA_Margin          7.9301e-05  9.6343e-05  0.8231 0.4108142
## Cap_Expend_to_Tot_Assets            2.7759e-02  8.9456e-02  0.3103 0.7564458
## Return_on_Invested_Capital          2.6850e-02  1.8399e-02  1.4593 0.1450740
## Tobin_s_Q_Ratio                    -1.3744e-01  3.5131e-01 -0.3912 0.6957879
## Total_Assets                        5.3633e+00  7.1678e-01  7.4825 3.007e-13
## Total_Debt_to_Total_Assets          1.1806e-02  2.3820e-02  0.4957 0.6203367
## Normalized_Net_Income_Growth       -5.7412e-05  1.9578e-04 -0.2932 0.7694495
## Revenue_Growth_Year_over_Year       9.9310e-05  5.2087e-04  0.1907 0.8488645
## Number_Of_Trades                    1.2724e+00  2.9527e-01  4.3093 1.949e-05
## Long_Term_Assets_as___Total_Assets -1.3010e-01  3.3820e-02 -3.8468 0.0001341
## Volatility_360_Day                  2.3902e-02  2.0808e-02  1.1487 0.2511868
##
## Trailing_12M_EBITDA_Margin
## Cap_Expend_to_Tot_Assets
## Return_on_Invested_Capital
## Tobin_s_Q_Ratio
## Total_Assets                       ***
## Total_Debt_to_Total_Assets
## Normalized_Net_Income_Growth
## Revenue_Growth_Year_over_Year
## Number_Of_Trades                   ***
## Long_Term_Assets_as___Total_Assets ***
## Volatility_360_Day
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Total Sum of Squares:    19810
## Residual Sum of Squares: 13026
## R-Squared:      0.34242
## Adj. R-Squared: 0.24059
## F-statistic: 25.3733 on 11 and 536 DF, p-value: < 2.22e-16
```

```
# Efeitos aleatórios

random <- plm(formula = f,
              data = tbl,
              index = c("Acao", "Ano"),
              model="random")
summary(random)
```

```
## Oneway (individual) effect Random Effect Model
##    (Swamy-Arora's transformation)
##
## Call:
## plm(formula = f, data = tbl, model = "random", index = c("Acao",
##     "Ano"))
##
## Unbalanced Panel: n = 73, T = 1-10, N = 620
##
## Effects:
##                  var std.dev share
## idiosyncratic 24.303   4.930 0.278
## individual    63.162   7.947 0.722
## theta:
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##  0.4729  0.8075  0.8075  0.7966  0.8075  0.8075
##
## Residuals:
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
## -19.8288  -2.9790   0.1034  -0.0097   3.2366  15.8850
##
## Coefficients:
##                                    Estimate  Std. Error z-value  Pr(>|z|)
## (Intercept)                     -2.1072e+01  4.7349e+00 -4.4504 8.571e-06
## Trailing_12M_EBITDA_Margin       7.3189e-05  9.7340e-05  0.7519 0.4521132
## Cap_Expend_to_Tot_Assets         9.3144e-02  8.8371e-02  1.0540 0.2918737
## Return_on_Invested_Capital       3.3411e-02  1.8535e-02  1.8026 0.0714525
## Tobin_s_Q_Ratio                 -2.0351e-01  3.4992e-01 -0.5816 0.5608419
## Total_Assets                     5.3212e+00  5.7942e-01  9.1836 < 2.2e-16
## Total_Debt_to_Total_Assets       3.4737e-02  2.2113e-02  1.5708 0.1162179
## Normalized_Net_Income_Growth    -7.4703e-05  1.9892e-04 -0.3756 0.7072500
## Revenue_Growth_Year_over_Year    1.8755e-04  5.2490e-04  0.3573 0.7208688
## Number_Of_Trades                 1.2110e+00  2.7156e-01  4.4596 8.211e-06
## Long_Term_Assets_as___Total_Assets -1.0704e-01  3.0631e-02 -3.4947 0.0004746
## Volatility_360_Day               1.2202e-02  2.0748e-02  0.5881 0.5564600
##
## (Intercept)                     ***
## Trailing_12M_EBITDA_Margin
## Cap_Expend_to_Tot_Assets
## Return_on_Invested_Capital      .
## Tobin_s_Q_Ratio
## Total_Assets                    ***
## Total_Debt_to_Total_Assets
## Normalized_Net_Income_Growth
## Revenue_Growth_Year_over_Year
## Number_Of_Trades                ***
## Long_Term_Assets_as___Total_Assets ***
## Volatility_360_Day
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Total Sum of Squares:    25001
## Residual Sum of Squares: 15327
## R-Squared:      0.38696
```

```
## Adj. R-Squared: 0.37587
## Chisq: 302.263 on 11 DF, p-value: < 2.22e-16
```

```
phtest(fixed, random)
```

```
##
##  Hausman Test
##
## data:  f
## chisq = 33.338, df = 11, p-value = 0.0004638
## alternative hypothesis: one model is inconsistent
```

```
# Determinantes do score Ambiental

f <- formula(paste("Environmental_Disclosure_Score ~", regressores))

# Efeitos fixos

fixed <- plm(formula = f,
             data = tbl,
             index = c("Acao", "Ano"),
             model="within")

summary(fixed)
```

```
## Oneway (individual) effect Within Model
##
## Call:
## plm(formula = f, data = tbl, model = "within", index = c("Acao",
##     "Ano"))
##
## Unbalanced Panel: n = 73, T = 1-10, N = 620
##
## Residuals:
##       Min.    1st Qu.     Median    3rd Qu.       Max.
## -33.868766  -4.118892  -0.093438   4.187831  25.808960
##
## Coefficients:
##                                      Estimate  Std. Error t-value  Pr(>|t|)
## Trailing_12M_EBITDA_Margin        -0.00024462  0.00016625 -1.4714 0.1417661
## Cap_Expend_to_Tot_Assets           0.09299642  0.15436474  0.6024 0.5471321
## Return_on_Invested_Capital         0.03646777  0.03174999  1.1486 0.2512368
## Tobin_s_Q_Ratio                   -0.57684091  0.60622184 -0.9515 0.3417621
## Total_Assets                       8.73725497  1.23687080  7.0640 5.049e-12
## Total_Debt_to_Total_Assets         0.02931750  0.04110313  0.7133 0.4759910
## Normalized_Net_Income_Growth      -0.00025953  0.00033784 -0.7682 0.4427101
## Revenue_Growth_Year_over_Year      0.00083651  0.00089882  0.9307 0.3524426
## Number_Of_Trades                   1.55082683  0.50951414  3.0437 0.0024513
## Long_Term_Assets_as___Total_Assets -0.22796145  0.05835988 -3.9061 0.0001058
## Volatility_360_Day                 0.00200128  0.03590600  0.0557 0.9555723
##
## Trailing_12M_EBITDA_Margin
## Cap_Expend_to_Tot_Assets
## Return_on_Invested_Capital
## Tobin_s_Q_Ratio
## Total_Assets                       ***
## Total_Debt_to_Total_Assets
## Normalized_Net_Income_Growth
## Revenue_Growth_Year_over_Year
## Number_Of_Trades                   **
## Long_Term_Assets_as___Total_Assets ***
## Volatility_360_Day
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Total Sum of Squares:    53254
## Residual Sum of Squares: 38789
## R-Squared:      0.27162
## Adj. R-Squared: 0.15883
## F-statistic: 18.1711 on 11 and 536 DF, p-value: < 2.22e-16
```

```
# Efeitos aleatórios

random <- plm(formula = f,
              data = tbl,
              index = c("Acao", "Ano"),
              model="random")
summary(random)
```

```
## Oneway (individual) effect Random Effect Model
##    (Swamy-Arora's transformation)
##
## Call:
## plm(formula = f, data = tbl, model = "random", index = c("Acao",
##     "Ano"))
##
## Unbalanced Panel: n = 73, T = 1-10, N = 620
##
## Effects:
##                   var std.dev share
## idiosyncratic  72.368   8.507 0.275
## individual    190.437  13.800 0.725
## theta:
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##  0.4752  0.8087  0.8087  0.7978  0.8087  0.8087
##
## Residuals:
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
## -30.3073  -5.0612   0.2500  -0.0207   5.4310  27.8234
##
## Coefficients:
##                                     Estimate  Std. Error z-value  Pr(>|z|)
## (Intercept)                       -6.0978e+01  8.1306e+00 -7.4998 6.391e-14
## Trailing_12M_EBITDA_Margin        -2.6588e-04  1.6689e-04 -1.5932  0.111118
## Cap_Expend_to_Tot_Assets           1.9573e-01  1.5155e-01  1.2916  0.196510
## Return_on_Invested_Capital         4.7576e-02  3.1779e-02  1.4971  0.134376
## Tobin_s_Q_Ratio                   -6.8236e-01  6.0003e-01 -1.1372  0.255456
## Total_Assets                       8.9912e+00  9.9544e-01  9.0323 < 2.2e-16
## Total_Debt_to_Total_Assets         7.0699e-02  3.7947e-02  1.8631  0.062451
## Normalized_Net_Income_Growth      -2.7813e-04  3.4102e-04 -0.8156  0.414735
## Revenue_Growth_Year_over_Year      9.7754e-04  8.9995e-04  1.0862  0.277383
## Number_Of_Trades                   1.4043e+00  4.6594e-01  3.0140  0.002578
## Long_Term_Assets_as___Total_Assets -2.1448e-01  5.2576e-02 -4.0795 4.514e-05
## Volatility_360_Day                -1.5798e-02  3.5578e-02 -0.4440  0.657015
##
## (Intercept)                       ***
## Trailing_12M_EBITDA_Margin
## Cap_Expend_to_Tot_Assets
## Return_on_Invested_Capital
## Tobin_s_Q_Ratio
## Total_Assets                      ***
## Total_Debt_to_Total_Assets        .
## Normalized_Net_Income_Growth
## Revenue_Growth_Year_over_Year
## Number_Of_Trades                  **
## Long_Term_Assets_as___Total_Assets ***
## Volatility_360_Day
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Total Sum of Squares:    64190
## Residual Sum of Squares: 45045
## R-Squared:      0.29827
```

```
## Adj. R-Squared: 0.28558
## Chisq: 236.527 on 11 DF, p-value: < 2.22e-16
```

```
phtest(fixed, random)
```

```
##
##  Hausman Test
##
## data:  f
## chisq = 41.904, df = 11, p-value = 1.683e-05
## alternative hypothesis: one model is inconsistent
```

```
# Determinantes do score Social

f <- formula(paste("Social_Disclosure_Score ~", regressores))
# Efeitos fixos

fixed <- plm(formula = f,
             data = tbl,
             index = c("Acao", "Ano"),
             model="within")
summary(fixed)
```

```
## Oneway (individual) effect Within Model
##
## Call:
## plm(formula = f, data = tbl, model = "within", index = c("Acao",
##     "Ano"))
##
## Unbalanced Panel: n = 73, T = 1-10, N = 620
##
## Residuals:
##       Min.    1st Qu.     Median    3rd Qu.       Max.
## -24.532516  -3.458195   0.016227   3.854072  22.531104
##
## Coefficients:
##                                     Estimate  Std. Error t-value  Pr(>|t|)
## Trailing_12M_EBITDA_Margin          4.1686e-05  1.3386e-04  0.3114  0.755602
## Cap_Expend_to_Tot_Assets            8.3513e-02  1.2429e-01  0.6719  0.501914
## Return_on_Invested_Capital          2.8033e-02  2.5563e-02  1.0966  0.273303
## Tobin_s_Q_Ratio                    -4.1502e-02  4.8810e-01 -0.0850  0.932271
## Total_Assets                        4.6169e+00  9.9587e-01  4.6360 4.467e-06
## Total_Debt_to_Total_Assets          1.3868e-02  3.3094e-02  0.4191  0.675343
## Normalized_Net_Income_Growth        4.4705e-05  2.7202e-04  0.1643  0.869520
## Revenue_Growth_Year_over_Year      -6.1610e-04  7.2368e-04 -0.8513  0.394959
## Number_Of_Trades                    1.6319e+00  4.1024e-01  3.9780 7.905e-05
## Long_Term_Assets_as___Total_Assets -1.5279e-01  4.6988e-02 -3.2517  0.001219
## Volatility_360_Day                  4.5347e-02  2.8910e-02  1.5686  0.117335
##
## Trailing_12M_EBITDA_Margin
## Cap_Expend_to_Tot_Assets
## Return_on_Invested_Capital
## Tobin_s_Q_Ratio
## Total_Assets                       ***
## Total_Debt_to_Total_Assets
## Normalized_Net_Income_Growth
## Revenue_Growth_Year_over_Year
## Number_Of_Trades                   ***
## Long_Term_Assets_as___Total_Assets **
## Volatility_360_Day
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Total Sum of Squares:    32412
## Residual Sum of Squares: 25146
## R-Squared:      0.22419
## Adj. R-Squared: 0.10406
## F-statistic: 14.0811 on 11 and 536 DF, p-value: < 2.22e-16
```

```
# Efeitos aleatórios

random <- plm(formula = f,
              data = tbl,
              index = c("Acao", "Ano"),
              model="random")
summary(random)
```

```
## Oneway (individual) effect Random Effect Model
##    (Swamy-Arora's transformation)
##
## Call:
## plm(formula = f, data = tbl, model = "random", index = c("Acao",
##     "Ano"))
##
## Unbalanced Panel: n = 73, T = 1-10, N = 620
##
## Effects:
##                   var std.dev share
## idiosyncratic  46.913   6.849 0.306
## individual    106.437  10.317 0.694
## theta:
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##  0.4469  0.7945  0.7945  0.7830  0.7945  0.7945
##
## Residuals:
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
## -24.4439  -4.3355  -0.0956   0.0034   4.3310  24.5787
##
## Coefficients:
##                                    Estimate  Std. Error z-value  Pr(>|z|)
## (Intercept)                     -3.1320e+01  6.4164e+00 -4.8812 1.054e-06
## Trailing_12M_EBITDA_Margin        3.9255e-05  1.3421e-04  0.2925 0.7699027
## Cap_Expend_to_Tot_Assets          1.5195e-01  1.2148e-01  1.2508 0.2109959
## Return_on_Invested_Capital        3.5919e-02  2.5544e-02  1.4061 0.1596887
## Tobin_s_Q_Ratio                 -3.5456e-02  4.8152e-01 -0.0736 0.9413014
## Total_Assets                      5.0495e+00  7.8060e-01  6.4687 9.883e-11
## Total_Debt_to_Total_Assets        3.5565e-02  3.0173e-02  1.1787 0.2385189
## Normalized_Net_Income_Growth      2.6301e-05  2.7442e-04  0.0958 0.9236463
## Revenue_Growth_Year_over_Year   -4.3355e-04  7.2358e-04 -0.5992 0.5490601
## Number_Of_Trades                  1.4067e+00  3.7118e-01  3.7899 0.0001507
## Long_Term_Assets_as___Total_Assets -1.0331e-01  4.1684e-02 -2.4785 0.0131951
## Volatility_360_Day                2.8201e-02  2.8554e-02  0.9876 0.3233297
##
## (Intercept)                        ***
## Trailing_12M_EBITDA_Margin
## Cap_Expend_to_Tot_Assets
## Return_on_Invested_Capital
## Tobin_s_Q_Ratio
## Total_Assets                       ***
## Total_Debt_to_Total_Assets
## Normalized_Net_Income_Growth
## Revenue_Growth_Year_over_Year
## Number_Of_Trades                   ***
## Long_Term_Assets_as___Total_Assets *
## Volatility_360_Day
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Total Sum of Squares:    38795
## Residual Sum of Squares: 29189
## R-Squared:      0.24761
```

```
## Adj. R-Squared: 0.234
## Chisq: 170.303 on 11 DF, p-value: < 2.22e-16
```

```
# Determinantes do score de Governança

f <- formula(paste("Governance_Disclosure_Score ~", regressores))

# Efeitos fixos

fixed <- plm(formula = f,
             data = tbl,
             index = c("Acao", "Ano"),
             model="within")
summary(fixed)
```

```
## Oneway (individual) effect Within Model
##
## Call:
## plm(formula = f, data = tbl, model = "within", index = c("Acao",
##     "Ano"))
##
## Unbalanced Panel: n = 73, T = 1-10, N = 620
##
## Residuals:
##       Min.    1st Qu.     Median    3rd Qu.       Max.
## -16.605834  -1.761160  -0.068944   1.582617  16.512414
##
## Coefficients:
##                                     Estimate  Std. Error t-value  Pr(>|t|)
## Trailing_12M_EBITDA_Margin          4.3961e-04  7.7374e-05  5.6816 2.191e-08
## Cap_Expend_to_Tot_Assets           -9.2780e-02  7.1842e-02 -1.2914  0.197108
## Return_on_Invested_Capital          1.6085e-02  1.4777e-02  1.0886  0.276841
## Tobin_s_Q_Ratio                     2.0497e-01  2.8214e-01  0.7265  0.467860
## Total_Assets                        2.7439e+00  5.7565e-01  4.7665 2.417e-06
## Total_Debt_to_Total_Assets         -7.6995e-03  1.9130e-02 -0.4025  0.687482
## Normalized_Net_Income_Growth        4.2348e-05  1.5724e-04  0.2693  0.787778
## Revenue_Growth_Year_over_Year       7.6962e-05  4.1832e-04  0.1840  0.854099
## Number_Of_Trades                    6.3685e-01  2.3713e-01  2.6856  0.007463
## Long_Term_Assets_as___Total_Assets -9.9611e-03  2.7161e-02 -0.3667  0.713956
## Volatility_360_Day                  2.4376e-02  1.6711e-02  1.4587  0.145236
##
## Trailing_12M_EBITDA_Margin         ***
## Cap_Expend_to_Tot_Assets
## Return_on_Invested_Capital
## Tobin_s_Q_Ratio
## Total_Assets                       ***
## Total_Debt_to_Total_Assets
## Normalized_Net_Income_Growth
## Revenue_Growth_Year_over_Year
## Number_Of_Trades                   **
## Long_Term_Assets_as___Total_Assets
## Volatility_360_Day
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Total Sum of Squares:    10966
## Residual Sum of Squares: 8401.8
## R-Squared:      0.23385
## Adj. R-Squared: 0.11522
## F-statistic: 14.8733 on 11 and 536 DF, p-value: < 2.22e-16
```

```
# Efeitos aleatórios

random <- plm(formula = f,
              data = tbl,
              index = c("Acao", "Ano"),
              model="random")
summary(random)
```

```
## Oneway (individual) effect Random Effect Model
##    (Swamy-Arora's transformation)
##
## Call:
## plm(formula = f, data = tbl, model = "random", index = c("Acao",
##     "Ano"))
##
## Unbalanced Panel: n = 73, T = 1-10, N = 620
##
## Effects:
##                  var std.dev share
## idiosyncratic 15.675   3.959 0.415
## individual    22.112   4.702 0.585
## theta:
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##  0.3559  0.7427  0.7427  0.7291  0.7427  0.7427
##
## Residuals:
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
## -12.9191  -2.1647  -0.2905  -0.0129   1.9204  19.9554
##
## Coefficients:
##                                     Estimate  Std. Error z-value  Pr(>|z|)
## (Intercept)                        3.0520e+01  3.4730e+00  8.7880 < 2.2e-16
## Trailing_12M_EBITDA_Margin         4.4755e-04  7.7462e-05  5.7777 7.574e-09
## Cap_Expend_to_Tot_Assets          -3.8325e-02  6.9188e-02 -0.5539    0.5796
## Return_on_Invested_Capital         1.8428e-02  1.4716e-02  1.2522    0.2105
## Tobin_s_Q_Ratio                    5.2490e-02  2.7550e-01  0.1905    0.8489
## Total_Assets                       1.6359e+00  4.1071e-01  3.9831 6.803e-05
## Total_Debt_to_Total_Assets         3.5987e-03  1.6655e-02  0.2161    0.8289
## Normalized_Net_Income_Growth       1.2564e-05  1.5879e-04  0.0791    0.9369
## Revenue_Growth_Year_over_Year      2.0877e-05  4.1743e-04  0.0500    0.9601
## Number_Of_Trades                   8.6203e-01  2.0729e-01  4.1585 3.204e-05
## Long_Term_Assets_as___Total_Assets  7.9282e-03  2.2762e-02  0.3483    0.7276
## Volatility_360_Day                 2.0993e-02  1.6341e-02  1.2847    0.1989
##
## (Intercept)                       ***
## Trailing_12M_EBITDA_Margin        ***
## Cap_Expend_to_Tot_Assets
## Return_on_Invested_Capital
## Tobin_s_Q_Ratio
## Total_Assets                      ***
## Total_Debt_to_Total_Assets
## Normalized_Net_Income_Growth
## Revenue_Growth_Year_over_Year
## Number_Of_Trades                  ***
## Long_Term_Assets_as___Total_Assets
## Volatility_360_Day
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Total Sum of Squares:    17517
## Residual Sum of Squares: 9802
## R-Squared:      0.44056
```

```
## Adj. R-Squared: 0.43044
## Chisq: 149.807 on 11 DF, p-value: < 2.22e-16
```

```
# Exploração :

# Caso Valor da empresa

f <- formula("Tobin_s_Q_Ratio ~ -1 +
              Trailing_12M_EBITDA_Margin +
              Cap_Expend_to_Tot_Assets +
              Return_on_Invested_Capital + ESG_Disclosure_Score +
              Total_Assets +
              Total_Debt_to_Total_Assets +
              Normalized_Net_Income_Growth +
              Revenue_Growth_Year_over_Year +
              Number_Of_Trades +
              Long_Term_Assets_as___Total_Assets + Volatility_360_Day")
# Efeitos fixos

fixed <- plm(formula = f,
             data = tbl,
             index = c("Acao", "Ano"),
             model="within")
summary(fixed)
```

```
## Oneway (individual) effect Within Model
##
## Call:
## plm(formula = f, data = tbl, model = "within", index = c("Acao",
##     "Ano"))
##
## Unbalanced Panel: n = 73, T = 1-10, N = 620
##
## Residuals:
##      Min.   1st Qu.    Median   3rd Qu.      Max.
## -1.902295 -0.212592 -0.029124  0.161249  4.500768
##
## Coefficients:
##                                      Estimate  Std. Error t-value  Pr(>|t|)
## Trailing_12M_EBITDA_Margin          1.0724e-05  1.1842e-05  0.9055  0.365584
## Cap_Expend_to_Tot_Assets            2.9742e-02  1.0923e-02  2.7229  0.006681
## Return_on_Invested_Capital          3.4722e-03  2.2614e-03  1.5354  0.125265
## ESG_Disclosure_Score               -2.0770e-03  5.3091e-03 -0.3912  0.695788
## Total_Assets                       -4.6787e-01  9.0370e-02 -5.1772 3.191e-07
## Total_Debt_to_Total_Assets         -1.1109e-03  2.9285e-03 -0.3794  0.704575
## Normalized_Net_Income_Growth       -1.7239e-05  2.4058e-05 -0.7165  0.473978
## Revenue_Growth_Year_over_Year      -8.9309e-05  6.3918e-05 -1.3972  0.162917
## Number_Of_Trades                    2.2064e-01  3.5670e-02  6.1855 1.229e-09
## Long_Term_Assets_as___Total_Assets -2.7747e-03  4.2129e-03 -0.6586  0.510416
## Volatility_360_Day                 -4.8747e-03  2.5524e-03 -1.9098  0.056687
##
## Trailing_12M_EBITDA_Margin
## Cap_Expend_to_Tot_Assets           **
## Return_on_Invested_Capital
## ESG_Disclosure_Score
## Total_Assets                       ***
## Total_Debt_to_Total_Assets
## Normalized_Net_Income_Growth
## Revenue_Growth_Year_over_Year
## Number_Of_Trades                   ***
## Long_Term_Assets_as___Total_Assets
## Volatility_360_Day                 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Total Sum of Squares:    220.32
## Residual Sum of Squares: 196.86
## R-Squared:      0.10647
## Adj. R-Squared: -0.031888
## F-statistic: 5.80647 on 11 and 536 DF, p-value: 6.4597e-09
```

```
# Caso Volatility

f <- formula("Volatility_360_Day ~ -1 +
             Trailing_12M_EBITDA_Margin +
             Cap_Expend_to_Tot_Assets +
             Return_on_Invested_Capital + ESG_Disclosure_Score +
             Total_Assets +
             Total_Debt_to_Total_Assets +
             Normalized_Net_Income_Growth +
             Revenue_Growth_Year_over_Year +
             Number_Of_Trades +
             Long_Term_Assets_as___Total_Assets +
             Tobin_s_Q_Ratio")
# Efeitos fixos

fixed <- plm(formula = f,
             data = tbl,
             index = c("Acao", "Ano"),
             model="within")
summary(fixed)
```

```
## Oneway (individual) effect Within Model
##
## Call:
## plm(formula = f, data = tbl, model = "within", index = c("Acao",
##     "Ano"))
##
## Unbalanced Panel: n = 73, T = 1-10, N = 620
##
## Residuals:
##     Min.  1st Qu.   Median  3rd Qu.     Max.
## -32.1916  -5.9629  -1.2336   4.4472  38.4172
##
## Coefficients:
##                                      Estimate  Std. Error t-value  Pr(>|t|)
## Trailing_12M_EBITDA_Margin         -0.00023335  0.00019962 -1.1690 0.2429310
## Cap_Expend_to_Tot_Assets           -0.68581920  0.18310210 -3.7456 0.0001995
## Return_on_Invested_Capital         -0.08653286  0.03803951 -2.2748 0.0233112
## ESG_Disclosure_Score                0.10274305  0.08944190  1.1487 0.2511868
## Total_Assets                        0.28174595  1.56171583  0.1804 0.8569005
## Total_Debt_to_Total_Assets          0.14941023  0.04897253  3.0509 0.0023945
## Normalized_Net_Income_Growth       -0.00045218  0.00040548 -1.1152 0.2652708
## Revenue_Growth_Year_over_Year      -0.00037610  0.00107983 -0.3483 0.7277526
## Number_Of_Trades                    1.37311404  0.61985442  2.2152 0.0271645
## Long_Term_Assets_as___Total_Assets -0.05154626  0.07104470 -0.7255 0.4684332
## Tobin_s_Q_Ratio                    -1.38655116  0.72600160 -1.9098 0.0566865
##
## Trailing_12M_EBITDA_Margin
## Cap_Expend_to_Tot_Assets           ***
## Return_on_Invested_Capital         *
## ESG_Disclosure_Score
## Total_Assets
## Total_Debt_to_Total_Assets         **
## Normalized_Net_Income_Growth
## Revenue_Growth_Year_over_Year
## Number_Of_Trades                   *
## Long_Term_Assets_as___Total_Assets
## Tobin_s_Q_Ratio                    .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Total Sum of Squares:    63720
## Residual Sum of Squares: 55994
## R-Squared:      0.12125
## Adj. R-Squared: -0.014827
## F-statistic: 6.72329 on 11 and 536 DF, p-value: 1.3024e-10
```