Análise Multinível SAEB 2019

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Modelagem Multinível

Carregamento de pacotes e dados

```
if (!require(pacman)) install.packages("pacman")
pacman::p_load(vroom,tidyverse, knitr, openxlsx, kableExtra, lmerTest, gridExtra, clipr,la
options(OutDec = ",")
setwd("C:/Users/User/Documents/GitHub/gradest-1/TCC/rel final")
```

Leitura dos dados

```
df <- vroom("dadostcc_3.csv")#, locale = locale(encoding = "UTF-8"), delim = ",")
```

```
New names:
Rows: 157841 Columns: 259
-- Column specification
-------------------------------------------------------- Delimiter: "," chr
(60): TX_RESP_BLOCO1_LP, TX_RESP_BLOCO2_LP, TX_RESP_BLOCO1_MT, TX_RESP_... dbl
(175): ...1, ID_ESCOLA, ID_REGIAO, ID_SAEB, ID_UF, ID_MUNICIPIO, ID_AREA... lgl
(24): CO_CONCEITO_Q1_CN, CO_CONCEITO_Q2_CN, Nivel_0_LPEMI, Nivel_1_LPEM...
i Use `spec()` to retrieve the full column specification for this data. i
Specify the column types or set `show_col_types = FALSE` to quiet this message.
* `` -> `...1`
```

```
var_df <- names(df)
dim(df)
```

```
[1] 157841    259
```

```
#df <- df %>%
#  filter(IN_PREENCHIMENTO_LP == 1, IN_PREENCHIMENTO_MT == 1)

set.seed(123)
df_sampled <- df %>% sample_n(5000)

theme_tcc <- function() {
  theme_classic() +
    theme(
      axis.line = element_line(colour = "black"),
      panel.border = element_rect(colour = "black", fill=NA),
      panel.background = element_blank(),
      plot.background = element_blank(),
      axis.ticks = element_line(colour = "black"),
      panel.grid.major = element_blank(),
      panel.grid.minor = element_blank(),
      axis.text = element_text(colour = "black"),
      axis.title = element_text(colour = "black")
    )
}
#rename variable NIVEL_SOCIO_ECONOMICO to NSE

df_sampled <- df_sampled %>%
  rename(NSE=NIVEL_SOCIO_ECONOMICO)
```

Modelo nulo

```
#modelo nulo
modelo_nulo <- lmer(PROFICIENCIA_LP_SAEB ~ 1 + (1|ID_ESCOLA), data = df_sampled)
summary(modelo_nulo)
```

```
Linear mixed model fit by REML. t-tests use Satterthwaite's method [
lmerModLmerTest]
Formula: PROFICIENCIA_LP_SAEB ~ 1 + (1 | ID_ESCOLA)
   Data: df_sampled

REML criterion at convergence: 52831,4
```

```
Scaled residuals:
    Min      1Q  Median      3Q     Max
-3,2353 -0,6574  0,0547  0,6776  2,7795

Random effects:
 Groups    Name        Variance Std.Dev.
 ID_ESCOLA (Intercept)  320,9   17,91
 Residual              2005,9   44,79
Number of obs: 5000, groups:  ID_ESCOLA, 1853

Fixed effects:
             Estimate Std. Error        df t value Pr(>|t|)
(Intercept)  256,7009     0,7963 1587,1994   322,4   <2e-16 ***
---
Signif. codes:  0 '***' 0,001 '**' 0,01 '*' 0,05 '.' 0,1 ' ' 1
```

```
#modelo_nulo <- lme(fixed=PROFICIENCIA_LP_SAEB ~ 1, random=~1|ID_ESCOLA, data = df_sampled

RandomEffects <- as.data.frame(VarCorr(modelo_nulo))
RandomEffects
```

```
        grp        var1 var2      vcov    sdcor
1 ID_ESCOLA (Intercept) <NA>  320,8992 17,91366
2  Residual        <NA> <NA> 2005,9281 44,78759
```

```
ICC_between <- RandomEffects[1,4]/(RandomEffects[1,4]+RandomEffects[2,4])
ICC_between
```

```
[1] 0,1379128
```

Modelo com variáveis preditoras

```
modelo1 <- lmer(PROFICIENCIA_LP_SAEB ~ NSE + ID_AREA + ID_LOCALIZACAO + TX_RESP_Q002 + TX_
summary(modelo1)
```

```
Linear mixed model fit by REML. t-tests use Satterthwaite's method [
lmerModLmerTest]
Formula:
```

```
PROFICIENCIA_LP_SAEB ~ NSE + ID_AREA + ID_LOCALIZACAO + TX_RESP_Q002 +
    TX_RESP_Q004 + TX_RESP_Q011 + TX_RESP_Q015 + TX_RESP_Q016 +
    TX_RESP_Q017A + TX_RESP_Q017B + TX_RESP_Q017C + TX_RESP_Q017D +
    TX_RESP_Q018A + TX_RESP_Q018B + (1 | ID_ESCOLA)
   Data: df_sampled

REML criterion at convergence: 51231,4

Scaled residuals:
    Min      1Q  Median      3Q     Max
-3,9554 -0,6318  0,0535  0,6763  2,8473

Random effects:
 Groups    Name        Variance Std.Dev.
 ID_ESCOLA (Intercept)  169,5   13,02
 Residual              1638,5   40,48
Number of obs: 4993, groups:  ID_ESCOLA, 1846

Fixed effects:
                Estimate Std. Error        df t value Pr(>|t|)
(Intercept)     161,0454    60,3937 4926,1349   2,667  0,00769 **
NSENível III    -18,2895    22,8241 3040,7723  -0,801  0,42301
NSENível IV     -13,8433    22,6191 3040,0278  -0,612  0,54057
NSENível V       -4,6398    22,6534 3038,7478  -0,205  0,83773
NSENível VI       9,3378    22,8065 2989,0316   0,409  0,68225
NSENível VII     33,7231    24,9652 2095,1573   1,351  0,17690
ID_AREA           7,7219     1,6094 1291,4135   4,798 1,79e-06 ***
ID_LOCALIZACAO   -1,1187     2,9999 3394,1275  -0,373  0,70924
TX_RESP_Q002.   -13,0188    14,4802 4782,5862  -0,899  0,36865
TX_RESP_Q002A    -7,8494    13,4739 4798,6554  -0,583  0,56022
TX_RESP_Q002B   -13,3334    13,5267 4796,5075  -0,986  0,32433
TX_RESP_Q002C   -12,7045    13,4489 4800,0858  -0,945  0,34489
TX_RESP_Q002D    -7,3569    13,8147 4788,5181  -0,533  0,59437
TX_RESP_Q002E   -20,0441    14,0316 4804,8280  -1,428  0,15322
TX_RESP_Q002F   -15,0494    13,6661 4798,8492  -1,101  0,27085
TX_RESP_Q004.     2,5557    11,0723 4813,1550   0,231  0,81747
TX_RESP_Q004A     4,4040     9,9856 4769,6700   0,441  0,65921
TX_RESP_Q004B     4,7932     9,9170 4797,7217   0,483  0,62888
TX_RESP_Q004C     7,3347     9,8234 4789,4267   0,747  0,45531
TX_RESP_Q004D    10,3112     9,7419 4790,5273   1,058  0,28991
TX_RESP_Q004E    12,1825     9,8009 4791,1678   1,243  0,21393
TX_RESP_Q004F    -1,2747     9,7435 4786,6305  -0,131  0,89592
TX_RESP_Q011.     8,9390    14,8409 4874,9858   0,602  0,54699
```

```
TX_RESP_Q011A    17,4957    14,2661 4870,4594   1,226  0,22012
TX_RESP_Q011B    13,8007    14,3191 4871,7411   0,964  0,33520
TX_RESP_Q011C     8,3263    14,4548 4870,4833   0,576  0,56462
TX_RESP_Q015.    40,5008    22,1159 4832,8112   1,831  0,06712 .
TX_RESP_Q015A    46,1264    21,3145 4823,1245   2,164  0,03051 *
TX_RESP_Q015B    23,5973    21,3433 4814,6160   1,106  0,26895
TX_RESP_Q015C    24,2135    21,4473 4824,8012   1,129  0,25896
TX_RESP_Q016.     8,1331    43,1384 4893,4414   0,189  0,85047
TX_RESP_Q016A   -12,2014    42,4088 4893,5138  -0,288  0,77358
TX_RESP_Q016B   -13,8517    42,4950 4893,8181  -0,326  0,74447
TX_RESP_Q016C    -6,7580    42,9391 4894,3613  -0,157  0,87495
TX_RESP_Q017A.   20,5159    11,1497 4920,4502   1,840  0,06582 .
TX_RESP_Q017AA    0,3730     9,5857 4921,5159   0,039  0,96896
TX_RESP_Q017AB    7,5276     9,3853 4926,4481   0,802  0,42255
TX_RESP_Q017AC   18,8491     9,3197 4927,3525   2,023  0,04318 *
TX_RESP_Q017AD   23,7193     9,2625 4927,8343   2,561  0,01047 *
TX_RESP_Q017B.  -14,8968     5,5408 4865,7110  -2,689  0,00720 **
TX_RESP_Q017BA    2,7565     3,7673 4883,8596   0,732  0,46440
TX_RESP_Q017BB   -0,6603     4,1149 4892,7918  -0,160  0,87251
TX_RESP_Q017BC    5,9593     4,0251 4890,6208   1,481  0,13880
TX_RESP_Q017BD    3,0310     4,2378 4859,0491   0,715  0,47449
TX_RESP_Q017C.   -3,4626     7,0956 4838,0031  -0,488  0,62558
TX_RESP_Q017CA   -0,9686     4,8996 4862,5250  -0,198  0,84330
TX_RESP_Q017CB    0,7108     4,4833 4874,8898   0,159  0,87404
TX_RESP_Q017CC    9,7835     4,4921 4885,7974   2,178  0,02946 *
TX_RESP_Q017CD    3,1764     4,5843 4890,4876   0,693  0,48841
TX_RESP_Q017D.   -7,8004    14,2898 4875,2549  -0,546  0,58518
TX_RESP_Q017DA   -9,5113    13,8568 4871,9427  -0,686  0,49249
TX_RESP_Q017DB   -1,4222    13,7137 4871,9672  -0,104  0,91741
TX_RESP_Q017DC   -0,2413    13,7129 4871,2033  -0,018  0,98596
TX_RESP_Q017DD   -8,9928    13,8023 4867,0358  -0,652  0,51472
TX_RESP_Q018A.   26,0494     9,8499 4905,6988   2,645  0,00820 **
TX_RESP_Q018AA   13,9913     7,8430 4917,7741   1,784  0,07450 .
TX_RESP_Q018AB   19,2306     7,8137 4920,6379   2,461  0,01388 *
TX_RESP_Q018AC   23,5282     7,8830 4918,1285   2,985  0,00285 **
TX_RESP_Q018B.    1,9408    14,3253 4864,9619   0,135  0,89224
TX_RESP_Q018BA    6,3487    13,1585 4888,0014   0,482  0,62949
TX_RESP_Q018BB   11,4397    13,1461 4883,3830   0,870  0,38423
TX_RESP_Q018BC   27,4318    13,2231 4887,3367   2,075  0,03808 *
---
Signif. codes:  0 '***' 0,001 '**' 0,01 '*' 0,05 '.' 0,1 ' ' 1
```

```
Correlation matrix not shown by default, as p = 62 > 12.
Use print(x, correlation=TRUE)  or
    vcov(x)        if you need it
```

```
modelo2 <- lmer(PROFICIENCIA_LP_SAEB ~ NSE + ID_AREA + PC_FORMACAO_DOCENTE_FINAL + (1|ID_E
summary(modelo2)
```

```
Linear mixed model fit by REML. t-tests use Satterthwaite's method [
lmerModLmerTest]
Formula: PROFICIENCIA_LP_SAEB ~ NSE + ID_AREA + PC_FORMACAO_DOCENTE_FINAL +
    (1 | ID_ESCOLA)
   Data: df_sampled

REML criterion at convergence: 52553,7

Scaled residuals:
    Min      1Q  Median      3Q     Max
-3,3945 -0,6524  0,0550  0,6720  2,7402

Random effects:
 Groups    Name        Variance Std.Dev.
 ID_ESCOLA (Intercept)  217,6   14,75
 Residual              2006,1   44,79
Number of obs: 4993, groups:  ID_ESCOLA, 1846

Fixed effects:
                           Estimate Std. Error         df t value Pr(>|t|)
(Intercept)               210,37723   25,18554 2894,51743   8,353  < 2e-16 ***
NSENível III               -0,45830   25,07801 2984,13176  -0,018  0,98542
NSENível IV                14,92234   24,73075 2975,35737   0,603  0,54629
NSENível V                 28,28887   24,74518 2972,45709   1,143  0,25304
NSENível VI                48,17766   24,91074 2922,70784   1,934  0,05321 .
NSENível VII               73,39253   27,34078 2031,81174   2,684  0,00733 **
ID_AREA                    11,39195    1,98360 1307,26647   5,743 1,15e-08 ***
PC_FORMACAO_DOCENTE_FINAL   0,08154    0,03894 1730,64662   2,094  0,03638 *
---
Signif. codes:  0 '***' 0,001 '**' 0,01 '*' 0,05 '.' 0,1 ' ' 1

Warning in abbreviate(rn, minlength = 11): abbreviate used with non-ASCII chars


Correlation of Fixed Effects:
```

```
Warning in abbreviate(rn, minlength = 6): abbreviate used with non-ASCII chars

Warning in abbreviate(rn, minlength = 6): abbreviate used with non-ASCII chars

            (Intr) NSENII NSENIV NSENvV NSENvVI NSENVII ID_ARE
NSENívelIII -0,968
NSENível IV -0,981  0,984
NSENível V  -0,982  0,983  0,998
NSENível VI -0,976  0,977  0,991  0,992
NSENívelVII -0,891  0,890  0,903  0,905  0,900
ID_AREA     -0,186  0,006  0,008  0,021  0,027   0,042
PC_FORMACAO -0,134  0,013 -0,003 -0,014 -0,023  -0,036   0,447
```

```
modelo3 <- lmer(PROFICIENCIA_LP_SAEB ~ NSE + ID_AREA + TX_RESP_Q004 + TX_RESP_Q011 + TX_RE
summary(modelo3)
```

```
Linear mixed model fit by REML. t-tests use Satterthwaite's method [
lmerModLmerTest]
Formula: PROFICIENCIA_LP_SAEB ~ NSE + ID_AREA + TX_RESP_Q004 + TX_RESP_Q011 +
    TX_RESP_Q017A + TX_RESP_Q017B + TX_RESP_Q017C + TX_RESP_Q017D +
    (1 | ID_ESCOLA)
   Data: df_sampled

REML criterion at convergence: 51812,9

Scaled residuals:
    Min      1Q  Median      3Q     Max
-3,8364 -0,6385  0,0610  0,6696  2,9007

Random effects:
 Groups    Name        Variance Std.Dev.
 ID_ESCOLA (Intercept)  171,2   13,09
 Residual              1803,0   42,46
Number of obs: 4993, groups:  ID_ESCOLA, 1846

Fixed effects:
               Estimate Std. Error        df t value Pr(>|t|)
(Intercept)    181,1543    34,0039 4469,7733   5,327 1,04e-07 ***
NSENível III    -8,6467    23,5925 3096,4714  -0,366  0,71402
NSENível IV     -2,3537    23,2871 3092,7311  -0,101  0,91950
NSENível V       6,7678    23,3034 3091,2765   0,290  0,77151
```

```
NSENível VI      23,1675    23,4480 3039,1422   0,988  0,32321
NSENível VII     47,7523    25,6499 2114,5620   1,862  0,06278 .
ID_AREA           8,6534     1,6640 1295,1683   5,200 2,31e-07 ***
TX_RESP_Q004.     0,1254    10,5427 4840,0343   0,012  0,99051
TX_RESP_Q004A     4,0435    10,4273 4811,6499   0,388  0,69820
TX_RESP_Q004B     3,6666    10,3593 4838,7236   0,354  0,72340
TX_RESP_Q004C     7,7183    10,2625 4829,7567   0,752  0,45203
TX_RESP_Q004D    12,4156    10,1762 4831,1740   1,220  0,22250
TX_RESP_Q004E    15,5413    10,2390 4831,3148   1,518  0,12912
TX_RESP_Q004F    -2,4944    10,1817 4827,0778  -0,245  0,80648
TX_RESP_Q011.     9,3212    15,3414 4905,1946   0,608  0,54349
TX_RESP_Q011A    15,2998    14,7861 4902,4441   1,035  0,30084
TX_RESP_Q011B    10,2884    14,8432 4903,4477   0,693  0,48826
TX_RESP_Q011C     4,4429    14,9789 4903,5249   0,297  0,76678
TX_RESP_Q017A.   35,7236    10,9280 4949,8807   3,269  0,00109 **
TX_RESP_Q017AA    0,6945     9,9044 4950,5280   0,070  0,94410
TX_RESP_Q017AB    9,5154     9,6886 4953,7385   0,982  0,32609
TX_RESP_Q017AC   23,6569     9,6174 4954,3783   2,460  0,01394 *
TX_RESP_Q017AD   28,3044     9,5603 4954,5285   2,961  0,00308 **
TX_RESP_Q017B.  -11,6458     5,6990 4909,2187  -2,043  0,04106 *
TX_RESP_Q017BA    4,9729     3,9264 4916,6809   1,267  0,20539
TX_RESP_Q017BB    1,8547     4,2886 4923,8960   0,432  0,66542
TX_RESP_Q017BC   10,2483     4,1913 4925,7161   2,445  0,01451 *
TX_RESP_Q017BD    6,2938     4,4150 4894,9258   1,426  0,15406
TX_RESP_Q017C.   -1,0252     7,0013 4880,2780  -0,146  0,88359
TX_RESP_Q017CA   -3,4584     5,0918 4891,1998  -0,679  0,49704
TX_RESP_Q017CB    0,3757     4,6667 4904,3788   0,081  0,93583
TX_RESP_Q017CC   10,9274     4,6734 4915,6903   2,338  0,01942 *
TX_RESP_Q017CD    5,2649     4,7704 4920,5238   1,104  0,26980
TX_RESP_Q017D.   -2,1213    14,5950 4915,0233  -0,145  0,88445
TX_RESP_Q017DA   -7,5244    14,2035 4911,9895  -0,530  0,59630
TX_RESP_Q017DB    5,3239    14,0549 4912,5406   0,379  0,70486
TX_RESP_Q017DC   10,0474    14,0577 4911,4206   0,715  0,47481
TX_RESP_Q017DD    2,3303    14,1480 4907,9974   0,165  0,86918
---
Signif. codes:  0 '***' 0,001 '**' 0,01 '*' 0,05 '.' 0,1 ' ' 1


Correlation matrix not shown by default, as p = 38 > 12.
Use print(x, correlation=TRUE)  or
    vcov(x)        if you need it
```

```r
modelo4 <- lmer(PROFICIENCIA_LP_SAEB ~ NSE + ID_AREA + TX_RESP_Q004 + TX_RESP_Q011 + TX_RE
summary(modelo4)
```

```
Linear mixed model fit by REML. t-tests use Satterthwaite's method [
lmerModLmerTest]
Formula: PROFICIENCIA_LP_SAEB ~ NSE + ID_AREA + TX_RESP_Q004 + TX_RESP_Q011 +
    TX_RESP_Q017A + TX_RESP_Q017B + TX_RESP_Q017C + TX_RESP_Q017D +
    (1 | ID_ESCOLA)
   Data: df_sampled

REML criterion at convergence: 51812,9

Scaled residuals:
    Min      1Q  Median      3Q     Max
-3,8364 -0,6385  0,0610  0,6696  2,9007

Random effects:
 Groups    Name        Variance Std.Dev.
 ID_ESCOLA (Intercept)  171,2   13,09
 Residual              1803,0   42,46
Number of obs: 4993, groups:  ID_ESCOLA, 1846

Fixed effects:
                Estimate Std. Error        df t value Pr(>|t|)
(Intercept)     181,1543    34,0039 4469,7733   5,327 1,04e-07 ***
NSENível III     -8,6467    23,5925 3096,4714  -0,366  0,71402
NSENível IV      -2,3537    23,2871 3092,7311  -0,101  0,91950
NSENível V        6,7678    23,3034 3091,2765   0,290  0,77151
NSENível VI      23,1675    23,4480 3039,1422   0,988  0,32321
NSENível VII     47,7523    25,6499 2114,5620   1,862  0,06278 .
ID_AREA           8,6534     1,6640 1295,1683   5,200 2,31e-07 ***
TX_RESP_Q004.     0,1254    10,5427 4840,0343   0,012  0,99051
TX_RESP_Q004A     4,0435    10,4273 4811,6499   0,388  0,69820
TX_RESP_Q004B     3,6666    10,3593 4838,7236   0,354  0,72340
TX_RESP_Q004C     7,7183    10,2625 4829,7567   0,752  0,45203
TX_RESP_Q004D    12,4156    10,1762 4831,1740   1,220  0,22250
TX_RESP_Q004E    15,5413    10,2390 4831,3148   1,518  0,12912
TX_RESP_Q004F    -2,4944    10,1817 4827,0778  -0,245  0,80648
TX_RESP_Q011.     9,3212    15,3414 4905,1946   0,608  0,54349
TX_RESP_Q011A    15,2998    14,7861 4902,4441   1,035  0,30084
TX_RESP_Q011B    10,2884    14,8432 4903,4477   0,693  0,48826
TX_RESP_Q011C     4,4429    14,9789 4903,5249   0,297  0,76678
```

```
TX_RESP_Q017A.   35,7236    10,9280 4949,8807   3,269  0,00109 **
TX_RESP_Q017AA    0,6945     9,9044 4950,5280   0,070  0,94410
TX_RESP_Q017AB    9,5154     9,6886 4953,7385   0,982  0,32609
TX_RESP_Q017AC   23,6569     9,6174 4954,3783   2,460  0,01394 *
TX_RESP_Q017AD   28,3044     9,5603 4954,5285   2,961  0,00308 **
TX_RESP_Q017B.  -11,6458     5,6990 4909,2187  -2,043  0,04106 *
TX_RESP_Q017BA    4,9729     3,9264 4916,6809   1,267  0,20539
TX_RESP_Q017BB    1,8547     4,2886 4923,8960   0,432  0,66542
TX_RESP_Q017BC   10,2483     4,1913 4925,7161   2,445  0,01451 *
TX_RESP_Q017BD    6,2938     4,4150 4894,9258   1,426  0,15406
TX_RESP_Q017C.   -1,0252     7,0013 4880,2780  -0,146  0,88359
TX_RESP_Q017CA   -3,4584     5,0918 4891,1998  -0,679  0,49704
TX_RESP_Q017CB    0,3757     4,6667 4904,3788   0,081  0,93583
TX_RESP_Q017CC   10,9274     4,6734 4915,6903   2,338  0,01942 *
TX_RESP_Q017CD    5,2649     4,7704 4920,5238   1,104  0,26980
TX_RESP_Q017D.   -2,1213    14,5950 4915,0233  -0,145  0,88445
TX_RESP_Q017DA   -7,5244    14,2035 4911,9895  -0,530  0,59630
TX_RESP_Q017DB    5,3239    14,0549 4912,5406   0,379  0,70486
TX_RESP_Q017DC   10,0474    14,0577 4911,4206   0,715  0,47481
TX_RESP_Q017DD    2,3303    14,1480 4907,9974   0,165  0,86918
---
Signif. codes:  0 '***' 0,001 '**' 0,01 '*' 0,05 '.' 0,1 ' ' 1


Correlation matrix not shown by default, as p = 38 > 12.
Use print(x, correlation=TRUE)  or
    vcov(x)        if you need it
```

```r
modelo5 <- lmer(PROFICIENCIA_LP_SAEB ~ NSE + ID_AREA + TX_RESP_Q004 + TX_RESP_Q011 + TX_RE
summary(modelo5)
```

```
Linear mixed model fit by REML. t-tests use Satterthwaite's method [
lmerModLmerTest]
Formula: PROFICIENCIA_LP_SAEB ~ NSE + ID_AREA + TX_RESP_Q004 + TX_RESP_Q011 +
    TX_RESP_Q017A + TX_RESP_Q017B + TX_RESP_Q017C + TX_RESP_Q017D +
    (1 | ID_ESCOLA)
   Data: df_sampled

REML criterion at convergence: 51812,9

Scaled residuals:
```

```
    Min      1Q  Median      3Q     Max
-3,8364 -0,6385  0,0610  0,6696  2,9007

Random effects:
 Groups    Name        Variance Std.Dev.
 ID_ESCOLA (Intercept)  171,2   13,09
 Residual              1803,0   42,46
Number of obs: 4993, groups:  ID_ESCOLA, 1846

Fixed effects:
               Estimate Std. Error        df t value Pr(>|t|)
(Intercept)    181,1543    34,0039 4469,7733   5,327 1,04e-07 ***
NSENível III    -8,6467    23,5925 3096,4714  -0,366  0,71402
NSENível IV     -2,3537    23,2871 3092,7311  -0,101  0,91950
NSENível V       6,7678    23,3034 3091,2765   0,290  0,77151
NSENível VI     23,1675    23,4480 3039,1422   0,988  0,32321
NSENível VII    47,7523    25,6499 2114,5620   1,862  0,06278 .
ID_AREA          8,6534     1,6640 1295,1683   5,200 2,31e-07 ***
TX_RESP_Q004.    0,1254    10,5427 4840,0343   0,012  0,99051
TX_RESP_Q004A    4,0435    10,4273 4811,6499   0,388  0,69820
TX_RESP_Q004B    3,6666    10,3593 4838,7236   0,354  0,72340
TX_RESP_Q004C    7,7183    10,2625 4829,7567   0,752  0,45203
TX_RESP_Q004D   12,4156    10,1762 4831,1740   1,220  0,22250
TX_RESP_Q004E   15,5413    10,2390 4831,3148   1,518  0,12912
TX_RESP_Q004F   -2,4944    10,1817 4827,0778  -0,245  0,80648
TX_RESP_Q011.    9,3212    15,3414 4905,1946   0,608  0,54349
TX_RESP_Q011A   15,2998    14,7861 4902,4441   1,035  0,30084
TX_RESP_Q011B   10,2884    14,8432 4903,4477   0,693  0,48826
TX_RESP_Q011C    4,4429    14,9789 4903,5249   0,297  0,76678
TX_RESP_Q017A.  35,7236    10,9280 4949,8807   3,269  0,00109 **
TX_RESP_Q017AA   0,6945     9,9044 4950,5280   0,070  0,94410
TX_RESP_Q017AB   9,5154     9,6886 4953,7385   0,982  0,32609
TX_RESP_Q017AC  23,6569     9,6174 4954,3783   2,460  0,01394 *
TX_RESP_Q017AD  28,3044     9,5603 4954,5285   2,961  0,00308 **
TX_RESP_Q017B. -11,6458     5,6990 4909,2187  -2,043  0,04106 *
TX_RESP_Q017BA   4,9729     3,9264 4916,6809   1,267  0,20539
TX_RESP_Q017BB   1,8547     4,2886 4923,8960   0,432  0,66542
TX_RESP_Q017BC  10,2483     4,1913 4925,7161   2,445  0,01451 *
TX_RESP_Q017BD   6,2938     4,4150 4894,9258   1,426  0,15406
TX_RESP_Q017C.  -1,0252     7,0013 4880,2780  -0,146  0,88359
TX_RESP_Q017CA  -3,4584     5,0918 4891,1998  -0,679  0,49704
TX_RESP_Q017CB   0,3757     4,6667 4904,3788   0,081  0,93583
TX_RESP_Q017CC  10,9274     4,6734 4915,6903   2,338  0,01942 *
```

```
TX_RESP_Q017CD    5,2649     4,7704 4920,5238   1,104  0,26980
TX_RESP_Q017D.   -2,1213    14,5950 4915,0233  -0,145  0,88445
TX_RESP_Q017DA   -7,5244    14,2035 4911,9895  -0,530  0,59630
TX_RESP_Q017DB    5,3239    14,0549 4912,5406   0,379  0,70486
TX_RESP_Q017DC   10,0474    14,0577 4911,4206   0,715  0,47481
TX_RESP_Q017DD    2,3303    14,1480 4907,9974   0,165  0,86918
---
Signif. codes:  0 '***' 0,001 '**' 0,01 '*' 0,05 '.' 0,1 ' ' 1


Correlation matrix not shown by default, as p = 38 > 12.
Use print(x, correlation=TRUE)  or
    vcov(x)        if you need it
```

Análise de resíduos

```r
residuos <- residuals(modelo5)
qqnorm(residuos)
qqline(residuos)
```