```r
# LME library examples
library(magrittr)
library(data.table)
library(lme4)
```

```
## Loading required package: Matrix
```

```r
# import test pseudo-panel statistics
dt_eff <- fread("output/rentsbi.csv")

# transform data accordingly
dt_eff[, variable_num := 0][variable == "prop_ren_w", variable_num := 1][variable == "prop_ren_k", varia
dt_mixed <- dt_eff[, list(years_bi, variable_num, value)]
setnames(dt_mixed,
    old = c("years_bi", "variable_num", "value"),
    new = c("year", "class", "rents")
)
dt_mixed$Covariate1 <- rbinom(n = nrow(dt_mixed), size = 10, prob = 0.2)

## estimate random correlated effects (Mixed Models)

# only effects, no covariates
fm1 <- lmer(rents ~ year + (year | class), data = dt_mixed)
```

```
## boundary (singular) fit: see help('isSingular')
```

```r
fm1 %>%
    summary() %>%
    print()
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: rents ~ year + (year | class)
##    Data: dt_mixed
##
## REML criterion at convergence: -64.4
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -1.8110 -0.5549 -0.1321  0.4860  1.8593
##
## Random effects:
##  Groups   Name        Variance  Std.Dev. Corr
##  class    (Intercept) 3.404e-05 0.005834
##           year        5.263e-05 0.007255 -1.00
##  Residual             1.142e-04 0.010687
## Number of obs: 14, groups:  class, 2
##
## Fixed effects:
##              Estimate Std. Error t value
## (Intercept) -0.004262   0.007603  -0.561
## year         0.011465   0.005325   2.153
##
## Correlation of Fixed Effects:
##      (Intr)
## year -0.724
```

```
## optimizer (nloptwrap) convergence code: 0 (OK)
## boundary (singular) fit: see help('isSingular')
```

```
print("------------------------------")
```

```
## [1] "------------------------------"
```

```
fm1 %>% print()
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: rents ~ year + (year | class)
##    Data: dt_mixed
## REML criterion at convergence: -64.3628
## Random effects:
##  Groups   Name        Std.Dev. Corr
##  class    (Intercept) 0.005834
##           year        0.007255 -1.00
##  Residual             0.010687
## Number of obs: 14, groups:  class, 2
## Fixed Effects:
## (Intercept)         year
##   -0.004262     0.011465
## optimizer (nloptwrap) convergence code: 0 (OK) ; 0 optimizer warnings; 1 lme4 warnings
```

```
print("------------------------------")
```

```
## [1] "------------------------------"
```

```
print("------------------------------")
```

```
## [1] "------------------------------"
```

```
# effects + one covariate/regressor
fm2 <- lmer(rents ~ year + Covariate1 + (year | class), data = dt_mixed)
```

```
## boundary (singular) fit: see help('isSingular')
```

```
fm2 %>%
    summary() %>%
    print()
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: rents ~ year + Covariate1 + (year | class)
##    Data: dt_mixed
##
## REML criterion at convergence: -54.3
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -1.8083 -0.4017 -0.2355  0.5427  1.7279
##
## Random effects:
##  Groups   Name        Variance  Std.Dev. Corr
##  class    (Intercept) 3.650e-05 0.006041
##           year        5.119e-05 0.007155 -1.00
##  Residual             1.229e-04 0.011085
## Number of obs: 14, groups:  class, 2
##
```

```
## Fixed effects:
##              Estimate Std. Error t value
## (Intercept) -0.002361   0.008688  -0.272
## year         0.011573   0.005276   2.194
## Covariate1  -0.001210   0.002325  -0.520
##
## Correlation of Fixed Effects:
##            (Intr) year
## year       -0.646
## Covariate1 -0.421 -0.039
## optimizer (nloptwrap) convergence code: 0 (OK)
## boundary (singular) fit: see help('isSingular')
```

```
print("------------------------------")
```

```
## [1] "------------------------------"
```

```
fm2 %>% print()
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: rents ~ year + Covariate1 + (year | class)
##    Data: dt_mixed
## REML criterion at convergence: -54.3129
## Random effects:
##  Groups   Name        Std.Dev. Corr
##  class    (Intercept) 0.006041
##           year        0.007155 -1.00
##  Residual             0.011085
## Number of obs: 14, groups:  class, 2
## Fixed Effects:
## (Intercept)         year   Covariate1
##   -0.002361     0.011573    -0.001210
## optimizer (nloptwrap) convergence code: 0 (OK) ; 0 optimizer warnings; 1 lme4 warnings
```

```
print("------------------------------")
```

```
## [1] "------------------------------"
```

```
print("------------------------------")
```

```
## [1] "------------------------------"
```