Decompose Right Hand Side Variables from Linear Regression

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Contents

Decompose RHS

> Go to the **RMD**, **R**, **PDF**, or **HTML** version of this file. Go back to fan's REconTools Package, R4Econ Repository (bookdown site), or Intro Stats with R Repository.

One runs a number of regressions. With different outcomes, and various right hand side variables.

What is the remaining variation in the left hand side variable if right hand side variable one by one is set to the average of the observed values.

- Dependency: *R4Econ/linreg/ivreg/ivregdfrow.R*

The code below does not work with categorical variables (except for dummies). Dummy variable inputs need to be converted to zero/one first.

```
ff_lr_decompose <- function(df, vars.y, vars.x, vars.c, vars.z, vars.other.keep,
                            list.vars.tomean, list.vars.tomean.name.suffix,
                            df.reg.out = NULL,
                            graph=FALSE, graph.nrow=2) {

    vars.xc <- c(vars.x, vars.c)

    # Regressions
    # regf.iv from C:\Users\fan\R4Econ\linreg\ivreg\ivregdfrow.R
    if(is.null(df.reg.out)) {
      df.reg.out <- as_tibble(
        bind_rows(lapply(vars.y, regf.iv,
                         vars.x=vars.x, vars.c=vars.c, vars.z=vars.z, df=df)))
    }

    # Select Variables
    str.esti.suffix <- '_Estimate'
    arr.esti.name <- paste0(vars.xc, str.esti.suffix)
    str.outcome.name <- 'vars_var.y'
    arr.columns2select <- c(arr.esti.name, str.outcome.name)
    # arr.columns2select

    # Generate dataframe for coefficients
    df.coef <- df.reg.out[,c(arr.columns2select)] %>%
      mutate_at(vars(arr.esti.name), as.numeric) %>% column_to_rownames(str.outcome.name)
```

```r
  # df.coef
  # str(df.coef)

  # Decomposition Step 1: gather
  df.decompose <- df %>%
    filter(svymthRound %in% c(12, 18, 24)) %>%
    select(one_of(c(vars.other.keep, vars.xc, vars.y))) %>%
    drop_na() %>%
    gather(variable, value, -one_of(c(vars.other.keep, vars.xc)))

  # Decomposition Step 2: mutate_at(vars, funs(mean = mean(.)))
  # the xc averaging could have taken place earlier, no difference in mean across variables
  df.decompose <- df.decompose %>%
    group_by(variable) %>%
    mutate_at(vars(c(vars.xc, 'value')), funs(mean = mean(.))) %>%
    ungroup()

  # Decomposition Step 3 With Loop
  for (i in 1:length(list.vars.tomean)) {
      var.decomp.cur <- (paste0('value', list.vars.tomean.name.suffix[[i]]))
      vars.tomean <- list.vars.tomean[[i]]
      var.decomp.cur
      df.decompose <- df.decompose %>%
        mutate((!!var.decomp.cur) :=
                 ff_lr_decompose_valadj(., df.coef, vars.tomean, str.esti.suffix))
  }

  # Additional Statistics
  df.decompose.var.frac <- df.decompose %>%
          select(variable, contains('value')) %>%
          group_by(variable) %>%
          summarize_all(funs(mean = mean, var = var)) %>%
          select(variable, matches('value')) %>% select(variable, ends_with("_var")) %>%
          mutate_if(is.numeric, funs( frac = (./value_var))) %>%
          mutate_if(is.numeric, round, 3)

  # Graph
  g.graph.dist <- NULL
  if (graph) {
    g.graph.dist <- df.decompose %>%
        select(variable, contains('value'), -value_mean) %>%
        rename(outcome = variable) %>%
        gather(variable, value, -outcome) %>%
        ggplot(aes(x=value, color = variable, fill = variable)) +
            geom_line(stat = "density") +
            facet_wrap(~ outcome, scales='free', nrow=graph.nrow)
  }

  # Return
  return(list(dfmain = df.decompose,
              dfsumm = df.decompose.var.frac,
              graph = g.graph.dist))
```

```r
}

# Support Function
ff_lr_decompose_valadj <- function(df, df.coef, vars.tomean, str.esti.suffix) {
    new_value <- (df$value +
                  rowSums((df[paste0(vars.tomean, '_mean')] - df[vars.tomean])
                          *df.coef[df$variable, paste0(vars.tomean, str.esti.suffix)]))
    return(new_value)
}
```

Decomposition Program

```r
# Library
library(tidyverse)
library(AER)

# Load Sample Data
setwd('C:/Users/fan/R4Econ/_data/')
df <- read_csv('height_weight.csv')
```

Prepare Decomposition Data

```
## Parsed with column specification:
## cols(
##   S.country = col_character(),
##   vil.id = col_double(),
##   indi.id = col_double(),
##   sex = col_character(),
##   svymthRound = col_double(),
##   momEdu = col_double(),
##   wealthIdx = col_double(),
##   hgt = col_double(),
##   wgt = col_double(),
##   hgt0 = col_double(),
##   wgt0 = col_double(),
##   prot = col_double(),
##   cal = col_double(),
##   p.A.prot = col_double(),
##   p.A.nProt = col_double()
## )
```

```r
# Source Dependency
source('C:/Users/fan/R4Econ/linreg/ivreg/ivregdfrow.R')

# Setting
options(repr.matrix.max.rows=50, repr.matrix.max.cols=50)
```

Data Cleaning.

```r
# Convert Variable for Sex which is categorical to Numeric
df <- df
df$male <- (as.numeric(factor(df$sex)) - 1)
summary(factor(df$sex))
```

```
## Female   Male
```

```
## 16446 18619
```

```r
summary(df$male)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   0.000   0.000   1.000   0.531   1.000   1.000
```

Parameters.

```r
var.y1 <- c('hgt')
var.y2 <- c('wgt')
vars.y <- c(var.y1, var.y2)
vars.x <- c('prot')
vars.c <- c('male', 'wgt0', 'hgt0', 'svymthRound')
vars.other.keep <- c('S.country', 'vil.id', 'indi.id', 'svymthRound')

# Decompose sequence
vars.tomean.first <- c('male', 'hgt0')
var.tomean.first.name.suffix <- '_A'
vars.tomean.third <- c(vars.tomean.first, 'prot')
var.tomean.third.name.suffix <- '_B'
vars.tomean.fourth <- c(vars.tomean.third, 'svymthRound')
var.tomean.fourth.name.suffix <- '_C'
list.vars.tomean = list(vars.tomean.first,
                        vars.tomean.third,
                        vars.tomean.fourth)
list.vars.tomean.name.suffix <- list(var.tomean.first.name.suffix,
                                     var.tomean.third.name.suffix,
                                     var.tomean.fourth.name.suffix)
```

```r
df.use <- df %>% filter(S.country == 'Guatemala') %>%
  filter(svymthRound %in% c(12, 18, 24))
vars.z <- NULL
list.out <-
  ff_lr_decompose(df=df.use, vars.y, vars.x, vars.c, vars.z, vars.other.keep,
                  list.vars.tomean, list.vars.tomean.name.suffix,
                  graph=TRUE, graph.nrow=1)
options(repr.matrix.max.rows=10, repr.matrix.max.cols=50)
head(list.out$dfmain,10) %>%
  kable() %>%
  kable_styling_fc_wide()
```

S.country	vil.id	indi.id	svymthRound	prot	male	wgt0	hgt0	variable	value	prot_mean	male_mean	wgt0_mean	hgt0_mean	svymthRound_mean	value_mean	value_A	value_B	value_C
Guatemala	3	1352	18	13.3	1	2545.2	47.4	hgt	70.2	20.64819	0.5499276	3312.297	49.75137	18.42547	73.41216	71.37891	71.70649	71.99313
Guatemala	3	1352	24	46.3	1	2545.2	47.4	hgt	75.8	20.64819	0.5499276	3312.297	49.75137	18.42547	73.41216	76.97891	75.83533	72.07980
Guatemala	3	1354	12	1.0	1	3634.3	51.2	hgt	66.3	20.64819	0.5499276	3312.297	49.75137	18.42547	73.41216	65.24416	66.12009	70.44889
Guatemala	3	1354	18	9.8	1	3634.3	51.2	hgt	69.2	20.64819	0.5499276	3312.297	49.75137	18.42547	73.41216	68.14416	68.62778	68.91442
Guatemala	3	1354	24	15.4	1	3634.3	51.2	hgt	75.3	20.64819	0.5499276	3312.297	49.75137	18.42547	73.41216	74.24416	74.47813	70.72260
Guatemala	3	1356	12	8.6	1	3911.8	51.9	hgt	68.1	20.64819	0.5499276	3312.297	49.75137	18.42547	73.41216	66.63250	67.16961	71.49842
Guatemala	3	1356	18	17.8	1	3911.8	51.9	hgt	74.1	20.64819	0.5499276	3312.297	49.75137	18.42547	73.41216	72.63250	72.75947	73.04611
Guatemala	3	1356	24	30.5	1	3911.8	51.9	hgt	77.1	20.64819	0.5499276	3312.297	49.75137	18.42547	73.41216	75.63250	75.19330	71.43777
Guatemala	3	1357	12	1.0	1	3791.4	52.6	hgt	71.5	20.64819	0.5499276	3312.297	49.75137	18.42547	73.41216	69.62083	70.49676	74.82557
Guatemala	3	1357	18	12.7	1	3791.4	52.6	hgt	77.8	20.64819	0.5499276	3312.297	49.75137	18.42547	73.41216	75.92083	76.27517	76.56181

```r
options(repr.plot.width = 10, repr.plot.height = 4)
list.out$dfsumm %>%
  kable() %>%
  kable_styling_fc_wide()
```

variable	value_var	value_mean_var	value_A_var	value_B_var	value_C_var	value_var_frac	value_mean_var_frac	value_A_var_frac	value_B_var_frac	value_C_var_frac
hgt	21.864	NA	20.264	18.384	8.395	1	NA	0.927	0.841	0.384
wgt	2965693.245	NA	2863501.267	2659434.374	2346296.982	1	NA	0.966	0.897	0.791

Example Guatemala OLS

```
df.use <- df %>% filter(S.country == 'Guatemala') %>%
  filter(svymthRound %in% c(12, 18, 24))
vars.z <- c('vil.id')
list.out <- ff_lr_decompose(
  df=df.use, vars.y, vars.x, vars.c, vars.z, vars.other.keep,
  list.vars.tomean, list.vars.tomean.name.suffix,
  graph=TRUE, graph.nrow=1)
```

Example Guatemala IV = vil.id

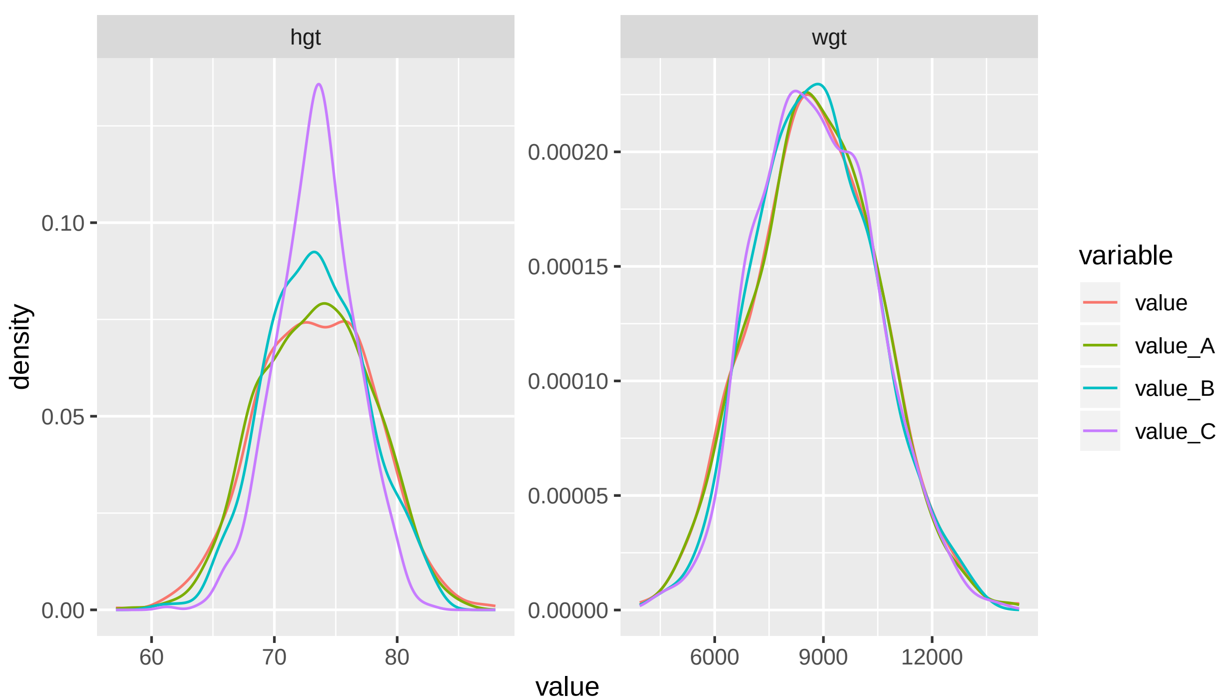
```
## Warning: attributes are not identical across measure variables;
## they will be dropped

## Warning: attributes are not identical across measure variables;
## they will be dropped
```

```
list.out$dfsumm %>%
  kable() %>%
  kable_styling_fc_wide()
```

variable	value_var	value_mean_var	value_A_var	value_B_var	value_C_var	value_var_frac	value_mean_var_frac	value_A_var_frac	value_B_var_frac	value_C_var_frac
hgt	21.864	NA	20.235	16.323	10.03	1	NA	0.926	0.747	0.459
wgt	2965693.245	NA	2876682.895	2676220.156	2583301.29	1	NA	0.970	0.902	0.871

```
options(repr.plot.width = 10, repr.plot.height = 2)
list.out$graph
```



```r
df.use <- df %>% filter(S.country == 'Cebu') %>%
  filter(svymthRound %in% c(12, 18, 24))
vars.z <- NULL
list.out <- ff_lr_decompose(
  df=df.use, vars.y, vars.x, vars.c, vars.z, vars.other.keep,
  list.vars.tomean, list.vars.tomean.name.suffix,
  graph=TRUE, graph.nrow=1)
options(repr.matrix.max.rows=10, repr.matrix.max.cols=50)
head(list.out$dfmain, 10) %>%
  kable() %>%
  kable_styling_fc_wide()
```

S.country	vil.id	indi.id	svymthRound	prot	male	wgt0	hgt0	variable	value	prot_mean	male_mean	wgt0_mean	hgt0_mean	svymthRound_mean	value_mean	value_A	value_B	value_C
Cebu	1	1	12	11.3	1	2043.8	44.2	hgt	70.8	16.95957	0.5263013	2988.773	49.23897	17.87441	74.99584	72.12171	72.33074	76.35522
Cebu	1	2	12	5.9	0	2839.9	49.7	hgt	72.2	16.95957	0.5263013	2988.773	49.23897	17.87441	74.99584	72.64812	73.05659	77.08108
Cebu	1	2	18	0.5	0	2839.9	49.7	hgt	76.5	16.95957	0.5263013	2988.773	49.23897	17.87441	74.99584	76.94812	77.55604	77.47000
Cebu	1	2	24	14.1	0	2839.9	49.7	hgt	79.2	16.95957	0.5263013	2988.773	49.23897	17.87441	74.99584	79.64812	79.75374	75.55718
Cebu	1	3	12	21.4	0	3445.6	51.7	hgt	68.0	16.95957	0.5263013	2988.773	49.23897	17.87441	74.99584	67.70200	67.53800	71.56248
Cebu	1	3	18	23.6	0	3445.6	51.7	hgt	71.6	16.95957	0.5263013	2988.773	49.23897	17.87441	74.99584	71.30200	71.05674	70.97071
Cebu	1	3	24	20.6	0	3445.6	51.7	hgt	76.7	16.95957	0.5263013	2988.773	49.23897	17.87441	74.99584	76.40200	76.26754	72.07099
Cebu	1	4	12	0.7	0	3090.9	50.2	hgt	69.1	16.95957	0.5263013	2988.773	49.23897	17.87441	74.99584	69.36159	69.96212	73.98660
Cebu	1	4	18	7.2	0	3090.9	50.2	hgt	74.3	16.95957	0.5263013	2988.773	49.23897	17.87441	74.99584	74.56159	74.92205	74.83601
Cebu	1	4	24	10.3	0	3090.9	50.2	hgt	78.1	16.95957	0.5263013	2988.773	49.23897	17.87441	74.99584	78.36159	78.60755	74.41100

```r
options(repr.plot.width = 10, repr.plot.height = 4)
list.out$dfsumm %>%
  kable() %>%
  kable_styling_fc_wide()
```

variable	value_var	value_mean_var	value_A_var	value_B_var	value_C_var	value_var_frac	value_mean_var_frac	value_A_var_frac	value_B_var_frac	value_C_var_frac
hgt	24.375	NA	22.561	21.309	10.001	1	NA	0.926	0.874	0.410
wgt	3337460.957	NA	3218987.397	3039513.634	2558514.368	1	NA	0.965	0.911	0.767

Example Cebu OLS

```r
df.use <- df %>% filter(S.country == 'Cebu') %>%
  filter(svymthRound %in% c(12, 18, 24))
vars.z <- c('wealthIdx')
list.out <- ff_lr_decompose(
  df=df.use, vars.y, vars.x, vars.c, vars.z, vars.other.keep,
  list.vars.tomean, list.vars.tomean.name.suffix,
  graph=TRUE, graph.nrow=1)
```

Example Cebu IV

```
## Warning: attributes are not identical across measure variables;
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## Warning: attributes are not identical across measure variables;
## they will be dropped
```
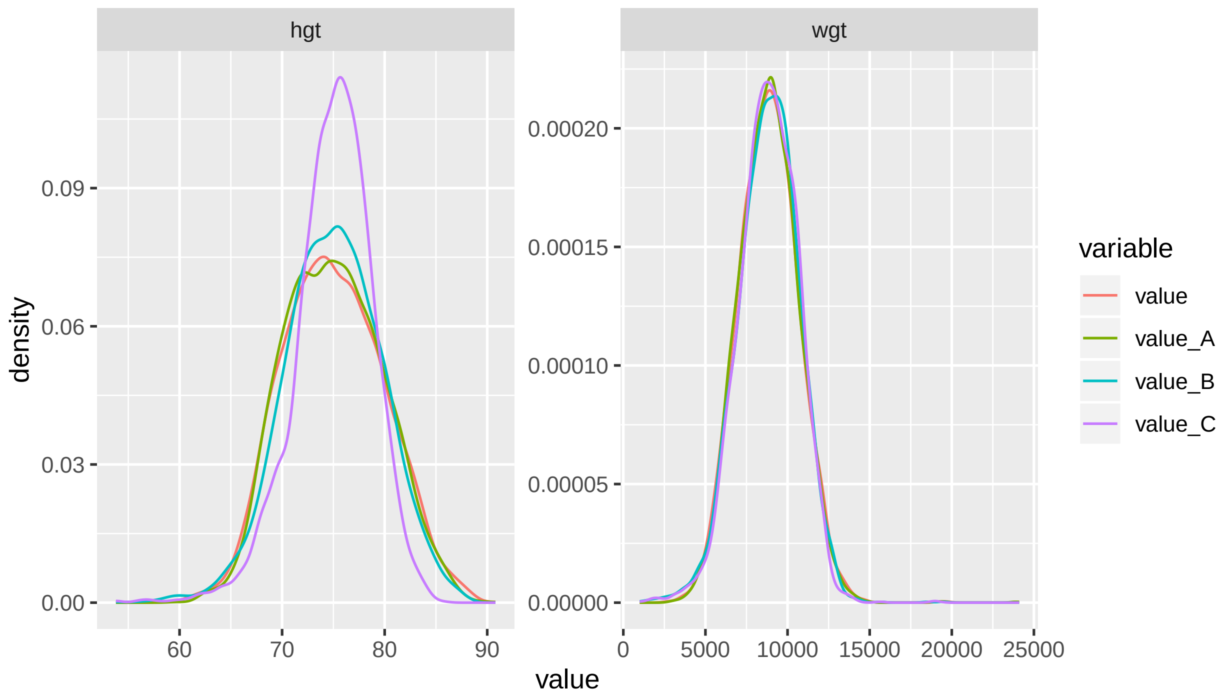

```r
list.out$dfsumm %>%
  kable() %>%
  kable_styling_fc_wide()
```

variable	value_var	value_mean_var	value_A_var	value_B_var	value_C_var	value_var_frac	value_mean_var_frac	value_A_var_frac	value_B_var_frac	value_C_var_frac
hgt	24.375	NA	22.625	22.194	14.392	1	NA	0.928	0.911	0.590
wgt	3337460.957	NA	3237415.252	3385814.742	3158659.340	1	NA	0.970	1.014	0.946

```r
options(repr.plot.width = 10, repr.plot.height = 2)
list.out$graph
```



Examples Line by Line The examples are just to test the code with different types of variables.

```r
df.use <- df %>% filter(S.country == 'Guatemala') %>%
  filter(svymthRound %in% c(12, 18, 24))
dim(df.use)
```

```
## [1] 2022   16
```

Setting Up Parameters.

```r
# Define Left Hand Side Variables
var.y1 <- c('hgt')
var.y2 <- c('wgt')
vars.y <- c(var.y1, var.y2)
# Define Right Hand Side Variables
vars.x <- c('prot')
vars.c <- c('male', 'wgt0', 'hgt0', 'svymthRound')
# vars.z <- c('p.A.prot')
vars.z <- c('vil.id')
# vars.z <- NULL
vars.xc <- c(vars.x, vars.c)

# Other variables to keep
vars.other.keep <- c('S.country', 'vil.id', 'indi.id', 'svymthRound')

# Decompose sequence
vars.tomean.first <- c('male', 'hgt0')
var.tomean.first.name.suffix <- '_mh02m'
```

```r
vars.tomean.second <- c(vars.tomean.first, 'hgt0', 'wgt0')
var.tomean.second.name.suffix <- '_mh0me2m'
vars.tomean.third <- c(vars.tomean.second, 'prot')
var.tomean.third.name.suffix <- '_mh0mep2m'
vars.tomean.fourth <- c(vars.tomean.third, 'svymthRound')
var.tomean.fourth.name.suffix <- '_mh0mepm2m'
list.vars.tomean = list(
#                          vars.tomean.first,
                        vars.tomean.second,
                        vars.tomean.third,
                        vars.tomean.fourth
                        )
list.vars.tomean.name.suffix <- list(
#                                    var.tomean.first.name.suffix,
                                     var.tomean.second.name.suffix,
                                     var.tomean.third.name.suffix,
                                     var.tomean.fourth.name.suffix
                                    )
```

```r
# Regressions
# regf.iv from C:\Users\fan\R4Econ\linreg\ivreg\ivregdfrow.R
df.reg.out <- as_tibble(
  bind_rows(lapply(vars.y, regf.iv,
                   vars.x=vars.x, vars.c=vars.c, vars.z=vars.z, df=df)))
```

Obtain Regression Coefficients from somewhere

```
## Warning: attributes are not identical across measure variables;
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## Warning: attributes are not identical across measure variables;
## they will be dropped
```

```r
# Regressions
# reg1 <- regf.iv(var.y = var.y1, vars.x, vars.c, vars.z, df.use)
# reg2 <- regf.iv(var.y = var.y2, vars.x, vars.c, vars.z, df.use)
# df.reg.out <- as_tibble(bind_rows(reg1, reg2))
```

```r
# df.reg.out
```

```r
# Select Variables
str.esti.suffix <- '_Estimate'
arr.esti.name <- paste0(vars.xc, str.esti.suffix)
str.outcome.name <- 'vars_var.y'
arr.columns2select <- c(arr.esti.name, str.outcome.name)
arr.columns2select
```

```
## [1] "prot_Estimate"        "male_Estimate"        "wgt0_Estimate"        "hgt0_Estimate"        "svyr
```

```r
# Generate dataframe for coefficients
df.coef <- df.reg.out[,c(arr.columns2select)] %>% mutate_at(vars(arr.esti.name), as.numeric) %>% column
df.coef %>%
  kable() %>%
  kable_styling_fc()
```

	prot_Estimate	male_Estimate	wgt0_Estimate	hgt0_Estimate	svymthRound_Estimate
hgt	-0.2714772	1.244735	0.0004430	0.6834853	1.133919
wgt	-59.0727542	489.852902	0.7696158	75.4867897	250.778883

```
str(df.coef)
```

```
## 'data.frame':    2 obs. of  5 variables:
##  $ prot_Estimate       : num  -0.271 -59.073
##  $ male_Estimate       : num  1.24 489.85
##  $ wgt0_Estimate       : num  0.000443 0.769616
##  $ hgt0_Estimate       : num  0.683 75.487
##  $ svymthRound_Estimate: num  1.13 250.78
```

```
# Decomposition Step 1: gather
df.decompose_step1 <- df.use %>%
                        filter(svymthRound %in% c(12, 18, 24)) %>%
                        select(one_of(c(vars.other.keep, vars.xc, vars.y))) %>%
                        drop_na() %>%
                        gather(variable, value, -one_of(c(vars.other.keep, vars.xc)))
options(repr.matrix.max.rows=20, repr.matrix.max.cols=20)
dim(df.decompose_step1)
```

Decomposition Step 1

```
## [1] 1382   10
```

```
head(df.decompose_step1, 10) %>%
  kable() %>%
  kable_styling_fc()
```

S.country	vil.id	indi.id	svymthRound	prot	male	wgt0	hgt0	variable	value
Guatemala	3	1352	18	13.3	1	2545.2	47.4	hgt	70.2
Guatemala	3	1352	24	46.3	1	2545.2	47.4	hgt	75.8
Guatemala	3	1354	12	1.0	1	3634.3	51.2	hgt	66.3
Guatemala	3	1354	18	9.8	1	3634.3	51.2	hgt	69.2
Guatemala	3	1354	24	15.4	1	3634.3	51.2	hgt	75.3
Guatemala	3	1356	12	8.6	1	3911.8	51.9	hgt	68.1
Guatemala	3	1356	18	17.8	1	3911.8	51.9	hgt	74.1
Guatemala	3	1356	24	30.5	1	3911.8	51.9	hgt	77.1
Guatemala	3	1357	12	1.0	1	3791.4	52.6	hgt	71.5
Guatemala	3	1357	18	12.7	1	3791.4	52.6	hgt	77.8

```
# Decomposition Step 2: mutate_at(vars, funs(mean = mean(.)))
# the xc averaging could have taken place earlier, no difference in mean across variables
df.decompose_step2 <- df.decompose_step1 %>%
                        group_by(variable) %>%
                        mutate_at(vars(c(vars.xc, 'value')), funs(mean = mean(.))) %>%
                        ungroup()

options(repr.matrix.max.rows=20, repr.matrix.max.cols=20)
dim(df.decompose_step2)
```

Decomposition Step 2

```
## [1] 1382   16
```

```
head(df.decompose_step2,10) %>%
  kable() %>%
  kable_styling_fc_wide()
```

S.country	vil.id	indi.id	svymthRound	prot	male	wgt0	hgt0	variable	value	prot_mean	male_mean	wgt0_mean	hgt0_mean	svymthRound_mean	value_mean
Guatemala	3	1352	18	13.3	1	2545.2	47.4	hgt	70.2	20.64819	0.5499276	3312.297	49.75137	18.42547	73.41216
Guatemala	3	1352	24	46.3	1	2545.2	47.4	hgt	75.8	20.64819	0.5499276	3312.297	49.75137	18.42547	73.41216
Guatemala	3	1354	12	1.0	1	3634.3	51.2	hgt	66.3	20.64819	0.5499276	3312.297	49.75137	18.42547	73.41216
Guatemala	3	1354	18	9.8	1	3634.3	51.2	hgt	69.2	20.64819	0.5499276	3312.297	49.75137	18.42547	73.41216
Guatemala	3	1354	24	15.4	1	3634.3	51.2	hgt	75.3	20.64819	0.5499276	3312.297	49.75137	18.42547	73.41216
Guatemala	3	1356	12	8.6	1	3911.8	51.9	hgt	68.1	20.64819	0.5499276	3312.297	49.75137	18.42547	73.41216
Guatemala	3	1356	18	17.8	1	3911.8	51.9	hgt	74.1	20.64819	0.5499276	3312.297	49.75137	18.42547	73.41216
Guatemala	3	1356	24	30.5	1	3911.8	51.9	hgt	77.1	20.64819	0.5499276	3312.297	49.75137	18.42547	73.41216
Guatemala	3	1357	12	1.0	1	3791.4	52.6	hgt	71.5	20.64819	0.5499276	3312.297	49.75137	18.42547	73.41216
Guatemala	3	1357	18	12.7	1	3791.4	52.6	hgt	77.8	20.64819	0.5499276	3312.297	49.75137	18.42547	73.41216

```
ff_lr_decompose_valadj <- function(df, df.coef, vars.tomean, str.esti.suffix) {
    new_value <- (df$value +
                  rowSums((df[paste0(vars.tomean, '_mean')] - df[vars.tomean])
                          *df.coef[df$variable, paste0(vars.tomean, str.esti.suffix)]))
    return(new_value)
}

# # Decomposition Step 3: mutate_at(vars, funs(mean = mean(.)))
# var.decomp.one <- (paste0('value', list.vars.tomean.name.suffix[[1]]))
# var.decomp.two <- (paste0('value', list.vars.tomean.name.suffix[[2]]))
# var.decomp.thr <- (paste0('value', list.vars.tomean.name.suffix[[3]]))
# df.decompose_step3 <- df.decompose_step2 %>%
#                           mutate((!!var.decomp.one) := f_decompose_here(., df.coef, list.vars.tomean[[1
#                                  (!!var.decomp.two) := f_decompose_here(., df.coef, list.vars.tomean[[2
#                                  (!!var.decomp.thr) := f_decompose_here(., df.coef, list.vars.tomean[[3

# options(repr.matrix.max.rows=10, repr.matrix.max.cols=20)
# dim(df.decompose_step3)
# df.decompose_step3
```

Decomposition Step 3 Non-Loop

```
df.decompose_step3 <- df.decompose_step2
for (i in 1:length(list.vars.tomean)) {
    var.decomp.cur <- (paste0('value', list.vars.tomean.name.suffix[[i]]))
    vars.tomean <- list.vars.tomean[[i]]
    var.decomp.cur
    df.decompose_step3 <- df.decompose_step3 %>%
      mutate((!!var.decomp.cur) :=
               ff_lr_decompose_valadj(., df.coef, vars.tomean, str.esti.suffix))

}
options(repr.matrix.max.rows=10, repr.matrix.max.cols=20)
dim(df.decompose_step3)
```

Decomposition Step 3 With Loop

```
## [1] 1382   19
```

```r
head(df.decompose_step3, 10) %>%
  kable() %>%
  kable_styling_fc_wide()
```

S.country	vil.id	indi.id	svymthRound	prot	male	wgt0	hgt0	variable	value	prot_mean	male_mean	wgt0_mean	hgt0_mean	svymthRound_mean	value_mean	value_mh0me2m	value_mh0mep2m	value_mh0mepm2m
Guatemala	3	1352	18	13.3	1	2545.2	47.4	hgt	70.2	20.64819	0.5499276	3312.297	49.75137	18.42547	73.41216	73.19390	71.19903	71.68148
Guatemala	3	1352	24	46.3	1	2545.2	47.4	hgt	75.8	20.64819	0.5499276	3312.297	49.75137	18.42547	73.41216	78.79390	85.75778	79.43671
Guatemala	3	1354	12	1.0	1	3634.3	51.2	hgt	66.3	20.64819	0.5499276	3312.297	49.75137	18.42547	73.41216	63.61689	58.28285	65.56882
Guatemala	3	1354	18	9.8	1	3634.3	51.2	hgt	69.2	20.64819	0.5499276	3312.297	49.75137	18.42547	73.41216	66.51689	63.57185	64.05430
Guatemala	3	1354	24	15.4	1	3634.3	51.2	hgt	75.3	20.64819	0.5499276	3312.297	49.75137	18.42547	73.41216	72.61689	71.19213	64.87106
Guatemala	3	1356	12	8.6	1	3911.8	51.9	hgt	68.1	20.64819	0.5499276	3312.297	49.75137	18.42547	73.41216	64.33707	61.06626	68.35222
Guatemala	3	1356	18	17.8	1	3911.8	51.9	hgt	74.1	20.64819	0.5499276	3312.297	49.75137	18.42547	73.41216	70.33707	69.56385	70.04630
Guatemala	3	1356	24	30.5	1	3911.8	51.9	hgt	77.1	20.64819	0.5499276	3312.297	49.75137	18.42547	73.41216	73.33707	76.01161	69.69055
Guatemala	3	1357	12	1.0	1	3791.4	52.6	hgt	71.5	20.64819	0.5499276	3312.297	49.75137	18.42547	73.41216	66.83353	61.49949	68.78545
Guatemala	3	1357	18	12.7	1	3791.4	52.6	hgt	77.8	20.64819	0.5499276	3312.297	49.75137	18.42547	73.41216	73.13353	70.97578	71.45823

```r
df.decompose_step3 %>%
        select(variable, contains('value')) %>%
        group_by(variable) %>%
        summarize_all(funs(mean = mean, var = var)) %>%
        select(matches('value')) %>% select(ends_with("_var")) %>%
        mutate_if(is.numeric, funs( frac = (./value_var))) %>%
        mutate_if(is.numeric, round, 3) %>%
  kable() %>%
  kable_styling_fc()
```

value_var	value_mean_var	value_mh0me2m_var	value_mh0mep2m_var	value_mh0mepm2m_var	value_va
21.864	NA	25.35	49.047	23.06	
2965693.245	NA	2949187.64	4192769.518	3147506.60	

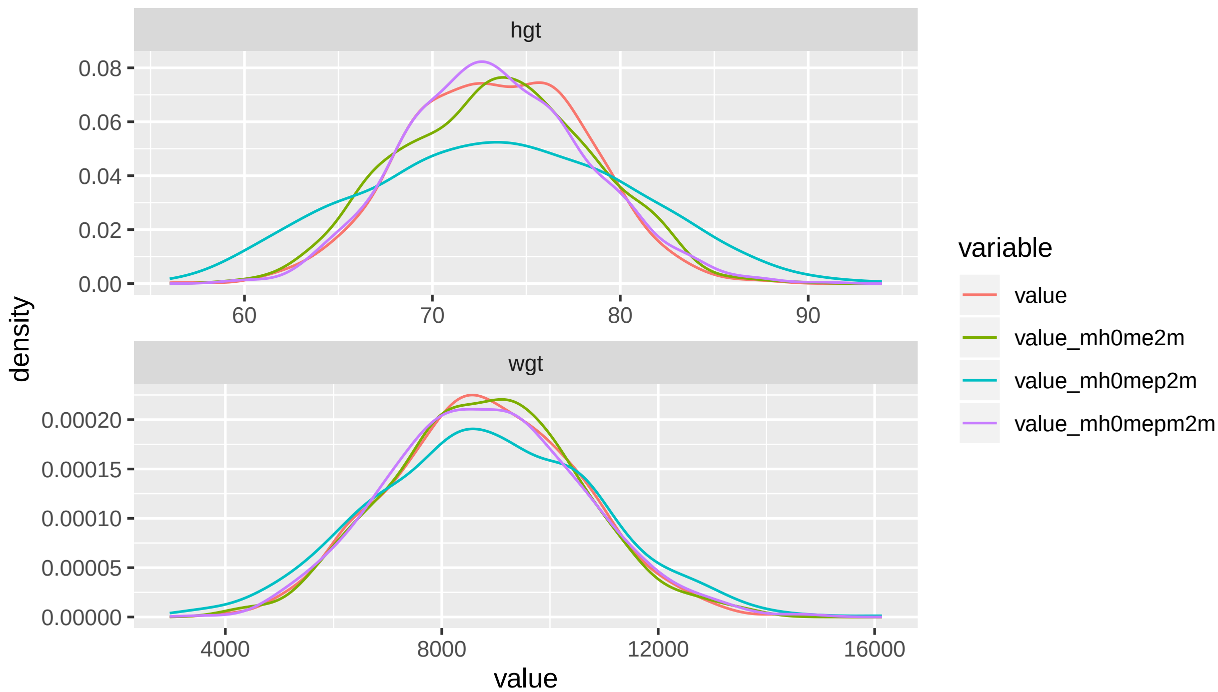
Decomposition Step 4 Variance

Graphical Results Graphically, difficult to pick up exact differences in variance, a 50 percent reduction in variance visually does not look like 50 percent. Intuitively, we are kind of seeing standard deviation, not variance on the graph if we think abou the x-scale.

```r
head(df.decompose_step3 %>%
    select(variable, contains('value'), -value_mean), 10) %>%
  kable() %>%
  kable_styling_fc_wide()
```

variable	value	value_mh0me2m	value_mh0mep2m	value_mh0mepm2m
hgt	70.2	73.19390	71.19903	71.68148
hgt	75.8	78.79390	85.75778	79.43671
hgt	66.3	63.61689	58.28285	65.56882
hgt	69.2	66.51689	63.57185	64.05430
hgt	75.3	72.61689	71.19213	64.87106
hgt	68.1	64.33707	61.06626	68.35222
hgt	74.1	70.33707	69.56385	70.04630
hgt	77.1	73.33707	76.01161	69.69055
hgt	71.5	66.83353	61.49949	68.78545
hgt	77.8	73.13353	70.97578	71.45823

```r
options(repr.plot.width = 10, repr.plot.height = 4)
df.decompose_step3 %>%
    select(variable, contains('value'), -value_mean) %>%
    rename(outcome = variable) %>%
    gather(variable, value, -outcome) %>%
    ggplot(aes(x=value, color = variable, fill = variable)) +
        geom_line(stat = "density") +
        facet_wrap(~ outcome, scales='free', nrow=2)
```




```r
head(df.decompose_step2[vars.tomean.first],3)
```

Additional Decomposition Testings

```
## # A tibble: 3 x 2
##    male  hgt0
##   <dbl> <dbl>
## 1     1  47.4
## 2     1  47.4
## 3     1  51.2
```

```r
head(df.decompose_step2[paste0(vars.tomean.first, '_mean')], 3)
```

```
## # A tibble: 3 x 2
##   male_mean hgt0_mean
##       <dbl>     <dbl>
## 1     0.550      49.8
## 2     0.550      49.8
## 3     0.550      49.8
```

```r
head(df.coef[df.decompose_step2$variable,
             paste0(vars.tomean.first, str.esti.suffix)], 3)
```

```
##        male_Estimate hgt0_Estimate
## hgt         1.244735     0.6834853
## hgt.1       1.244735     0.6834853
## hgt.2       1.244735     0.6834853
```

```r
df.decompose.tomean.first <- df.decompose_step2 %>%
    mutate(pred_new = df.decompose_step2$value +
        rowSums((df.decompose_step2[paste0(vars.tomean.first, '_mean')]
                 - df.decompose_step2[vars.tomean.first])
            *df.coef[df.decompose_step2$variable,
                     paste0(vars.tomean.first, str.esti.suffix)])) %>%
        select(variable, value, pred_new)
head(df.decompose.tomean.first, 10)
```

```
## # A tibble: 10 x 3
##    variable value pred_new
##    <chr>    <dbl>    <dbl>
##  1 hgt       70.2     71.2
##  2 hgt       75.8     76.8
##  3 hgt       66.3     64.7
##  4 hgt       69.2     67.6
##  5 hgt       75.3     73.7
##  6 hgt       68.1     66.1
##  7 hgt       74.1     72.1
##  8 hgt       77.1     75.1
##  9 hgt       71.5     69.0
## 10 hgt       77.8     75.3
```

```r
df.decompose.tomean.first %>%
        group_by(variable) %>%
        summarize_all(funs(mean = mean, sd = sd))  %>%
  kable() %>%
  kable_styling_fc()
```

variable	value_mean	pred_new_mean	value_sd	pred_new_sd
hgt	73.41216	73.41216	4.675867	4.534947
wgt	8807.87656	8807.87656	1722.118824	1695.221845

Note the r-square from regression above matches up with the 1 - ratio below. This is the proper decomposition method that is equivalent to r2.

```r
df.decompose_step2 %>%
    mutate(pred_new = df.decompose_step2$value +
        rowSums((df.decompose_step2[paste0(vars.tomean.second, '_mean')]
                 - df.decompose_step2[vars.tomean.second])
            *df.coef[df.decompose_step2$variable,
                     paste0(vars.tomean.second, str.esti.suffix)])) %>%
        select(variable, value, pred_new) %>%
        group_by(variable) %>%
        summarize_all(funs(mean = mean, var = var)) %>%
        mutate(ratio = (pred_new_var/value_var))  %>%
  kable() %>%
```

```r
kable_styling_fc()
```

variable	value_mean	pred_new_mean	value_var	pred_new_var	ratio
hgt	73.41216	73.41216	2.186374e+01	25.3504	1.1594724
wgt	8807.87656	8807.87656	2.965693e+06	2949187.6357	0.9944345