R OLS and Instrumental Variable Regression M Outcomes and N RHS Alternatives

Fan Wang

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Contents

IV Loop over 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.

Regression with a Variety of Outcome Variables and Right Hand Side Variables. There are M outcome variables, and there are N alternative right hand side variables. Regress each M outcome variable and each N alternative right hand side variable, with some common sets of controls and perhaps shared instruments. The output file is a M by N matrix of coefficients, with proper variable names and row names. The matrix stores coefficients for this key endogenous variable.

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

Construct Program The program relies on double lapply. lapply is used for convenience, not speed.

```
ff_reg_mbyn <- function(list.vars.y, list.vars.x,
                        vars.c, vars.z, df,
                        return_all = FALSE,
                        stats_ends = 'value', time = FALSE) {

    # regf.iv() function is from C:\Users\fan\R4Econ\linreg\ivreg\ivregdfrow.R
    if (time) {
        start_time <- Sys.time()
    }

    if (return_all) {
        df.reg.out.all <- bind_rows(lapply(list.vars.x,
                                function(x) (
                                    bind_rows(lapply(list.vars.y, regf.iv, vars.x=x, vars.c=vars.c, vars.z
                                )))

    } else {
        df.reg.out.all <- (lapply(list.vars.x,
                                function(x) (
                                    bind_rows(lapply(list.vars.y, regf.iv, vars.x=x, vars.c=vars.c, vars.z
                                        select(vars_var.y, starts_with(x)) %>%
                                        select(vars_var.y, ends_with(stats_ends))
                                )) %>% reduce(full_join)
```

```
    }

    if (time) {
        end_time <- Sys.time()
        print(paste0('Estimation for all ys and xs took (seconds):', end_time - start_time))
    }

    return(df.reg.out.all)
}
```

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

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

Prepare 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()
## )
```

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

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

Parameters.

```
var.y1 <- c('hgt')
var.y2 <- c('wgt')
var.y3 <- c('vil.id')
list.vars.y <- c(var.y1, var.y2, var.y3)

var.x1 <- c('prot')
var.x2 <- c('cal')
```

```
var.x3 <- c('wealthIdx')
var.x4 <- c('p.A.prot')
var.x5 <- c('p.A.nProt')
list.vars.x <- c(var.x1, var.x2, var.x3, var.x4, var.x5)

vars.z <- c('indi.id')
vars.c <- c('sex', 'wgt0', 'hgt0', 'svymthRound')
```

Program Testing

```
vars.z <- NULL
suppressMessages(ff_reg_mbyn(list.vars.y, list.vars.x,
                             vars.c, vars.z, df,
                             return_all = FALSE,
                             stats_ends = 'value'))
```

Test Program OLS Z-Stat

```
##   vars_var.y       prot_tvalue        cal_tvalue wealthIdx_tvalue  p.A.prot_tvalue p.A.nProt_tvalue
## 1        hgt  18.8756010031786  23.4421863484661  13.508899618216 3.83682180045518 32.5448257554855
## 2        wgt  16.3591125056062  17.3686031309332 14.1390521528113 1.36958319982295 12.0961557911467
## 3     vil.id -14.9385580468907 -19.6150110809452 34.0972558327347 8.45943342783186 17.7801422421419
```

```
vars.z <- c('indi.id')
suppressMessages(ff_reg_mbyn(list.vars.y, list.vars.x,
                             vars.c, vars.z, df,
                             return_all = FALSE,
                             stats_ends = 'value'))
```

Test Program IV T-stat

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

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```

```
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```

```
##   vars_var.y       prot_zvalue        cal_zvalue  wealthIdx_zvalue   p.A.prot_zvalue  p.A.nProt_zvalu
## 1        hgt  8.87674929300964  12.0739764947235  4.62589553677969  26.6373587567312  32.116219238574
## 2        wgt  5.60385871756365   6.1225187008946  5.17869536991717  11.9295584469998  12.350930701726
## 3    vil.id -9.22106223347162 -13.0586007975839 -51.5866689219593 -29.9627476577329 -38.352889462070
```

```
vars.z <- NULL
suppressMessages(ff_reg_mbyn(list.vars.y, list.vars.x,
                             vars.c, vars.z, df,
                             return_all = FALSE,
                             stats_ends = 'Estimate'))
```

Test Program OLS Coefficient

```
##   vars_var.y       prot_Estimate         cal_Estimate wealthIdx_Estimate    p.A.prot_Estimate  p.A.nP
## 1        hgt   0.049431093806755  0.00243408846205622   0.21045655488185 3.86952250259526e-05 0.00541
## 2        wgt    16.5557424523585    0.699072500364623   106.678721085969  0.00521731297924587   0.779
## 3    vil.id -0.0758835879205584 -0.00395676177098486  0.451733304543324 0.000149388430455142 0.00526
```

```
vars.z <- c('indi.id')
suppressMessages(ff_reg_mbyn(list.vars.y, list.vars.x,
                             vars.c, vars.z, df,
                             return_all = FALSE,
                             stats_ends = 'Estimate'))
```

Test Program IV coefficient

```
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```

```
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```

```
##   vars_var.y     prot_Estimate       cal_Estimate wealthIdx_Estimate    p.A.prot_Estimate  p.A.nProt
## 1        hgt 0.859205733632614 0.0238724384575419  0.144503490136948  0.00148073028434642  0.0141317
## 2        wgt  98.9428234201406   2.71948246216953   69.1816142883022    0.221916473012486    2.11856
## 3     vil.id -6.02451379136132 -0.168054407187466  -1.91414470908345 -0.00520794333267238 -0.0494468
```

```
vars.z <- NULL
ff_reg_mbyn(list.vars.y, list.vars.x,
            vars.c, vars.z, df,
            return_all = TRUE,
            stats_ends = 'Estimate')
```

Test Program OLS Return All

```
##    X.Intercept._Estimate X.Intercept._Pr...t.. X.Intercept._Std.Error X.Intercept._tvalue    adj.r.sq
## 1       27.3528514188608 5.68247182214952e-231      0.831272666092284    32.9047886867776  0.8142490
## 2        99.873884728925      0.75529705553815       320.450650378664    0.31166697465244   0.607169
## 3       31.4646660224049  6.78164655340399e-84       1.61328519718754     19.503474077155 0.03732475
## 4       27.9038445914729 8.24252673989353e-242      0.828072565159449    33.6973421962119   0.816089
## 5       219.626705179399     0.493216914827181       320.522532223672   0.685214557790078  0.6078636
## 6       30.5103987898551  1.62608789535248e-79       1.60831193651104    18.9704485163756 0.04534987
## 7       35.7840188807906 2.26726906489443e-145       1.38461348429899    25.8440491058106  0.9350149
## 8      -2662.74787734003  7.13318862990131e-05       670.301542938561   -3.97246270039407   0.921936
## 9       29.2381039651127 1.53578035267873e-124       1.22602177264147    23.8479483950102  0.0595431
## 10      23.9948407749744 2.11912344053336e-165       0.86658104216672    27.6890903532576  0.8146908
## 11     -547.959546430028    0.0941551350855875       327.343126852912   -1.6739607509042  0.6173005
## 12      22.3367814226238  3.04337266226599e-49        1.5098937308759    14.7936116071335 0.02611310
## 13      24.4904444950827 2.34941965806705e-181      0.843371070670838    29.0387533397398  0.8245423
## 14     -476.703973630552     0.143844033032183       326.132837036936   -1.46168652614567  0.6202507
## 15      22.7781908464511  9.58029450711211e-52        1.5004526558957    15.1808794212527 0.03854373
##            hgt0_Pr...t..     hgt0_Std.Error       hgt0_tvalue       prot_Estimate        prot_Pr...t
## 1  1.14533314566771e-183 0.0206657538633713  29.2231378249683   0.049431093806755 9.54769322304645e-
## 2   1.52417506966835e-12   7.96735224000553   7.0770314931977    16.5557424523585 9.61203373222183e-
## 3   1.40290395213743e-13 0.0401060913799595 -7.40147890309685 -0.0758835879205584 3.56396093562335e-
## 4  7.79174951119325e-177 0.0205836398278421  28.6561486875877                <NA>                <NA
## 5   3.05720143843395e-11   7.96822145797115  6.64774497790599                <NA>                <NA
## 6   8.49149153665126e-12 0.0399777363511633 -6.83428417151858                <NA>                <NA
## 7   2.71000479249152e-36 0.0348701896610764  12.6002885423502                <NA>                <NA
## 8    0.00520266507060071   16.8823489375743  2.79445531182864                <NA>                <NA
## 9   2.41020063623865e-31 0.0307984635553859  -11.659076407325                <NA>                <NA
## 10 1.31914432912869e-220 0.0213841849324282  32.1391351404584                <NA>                <NA
## 11  4.78613024244006e-19   8.07744906400683  8.92677379355593                <NA>                <NA
## 12    0.0034801146146182 0.0372288594891345 -2.92217281443323                <NA>                <NA
## 13 1.11511327164938e-190 0.0208846437570215  29.8015803204665                <NA>                <NA
## 14  8.38546282719268e-15   8.07589192978212  7.76801157994423                <NA>                <NA
## 15  2.13723119924676e-05 0.0371223237183417 -4.25112470577158                <NA>                <NA
##          r.squared_v   sexMale_Estimate     sexMale_Pr...t..  sexMale_Std.Error    sexMale_tvalue
## 1   0.814298005954592  0.935177182449406 2.36432111724607e-51 0.0618482294097262  15.1205166481668 4
## 2   0.607272921412825   415.163616765357 2.48252880290814e-67   23.8518341439675  17.4059409544552 1
## 3  0.0375780335372857 -0.254089999175318   0.0343768259467621  0.120093045309631 -2.11577613441484 8
## 4   0.816137722617266  0.893484662055608 2.08765935335877e-47 0.0616078355613525  14.5027763743757 4
## 5    0.60796705182314   405.534891838028 2.51355675686752e-64   23.8567507583516  16.9987478993157 1
## 6  0.0456010419476623 -0.181389489610951    0.129768754080748   0.11972270545355 -1.51508010885476 8
## 7    0.93502787877066   1.80682463132073 1.26527362032354e-66  0.104475287357902  17.2942776901016 8
## 8   0.921952383432195   999.926876716707 2.64630894140004e-86   50.5879876531386  19.7660931597596 3
## 9  0.0596997716363463  -0.33436777751525 0.000311174554787706 0.0927193334338799 -3.60623577771614 7
## 10  0.814740639193486  0.932686930233136 7.90489020586094e-47 0.0647209948973267  14.4108867873979 4
## 11  0.617403496088206   397.141948675354 6.19449742677662e-59   24.4473730956481  16.2447698213453 1
## 12 0.0263714328556815 -0.445232370681998 7.93666802281971e-05  0.112797805327952 -3.94717228218682  
## 13  0.824589538985803   0.96466980500711 1.24556615236597e-52 0.0629827627260302   15.316409812052 4
## 14  0.620352835549783    401.59056368102 1.18469030741261e-60   24.3549086073387  16.4891016491029 1
## 15 0.0387987636986586 -0.423829627017582  0.00015644693636154  0.112083516545945 -3.78137339083082 7
##    svymthRound_Pr...t.. svymthRound_Std.Error svymthRound_tvalue vars_var.y              vars_vars.
## 1                     0   0.00387681209575621   224.840892330022        hgt sex+wgt0+hgt0+svymthRound
## 2                     0       1.4955473831309   126.403823119306        wgt sex+wgt0+hgt0+svymthRound
## 3    0.0397984032097113   0.00752730297891317  -2.05597660181154     vil.id sex+wgt0+hgt0+svymthRound
## 4                     0   0.00411253488213795   207.168832400006        hgt sex+wgt0+hgt0+svymthRound
## 5                     0      1.59266949679221   116.357025971267        wgt sex+wgt0+hgt0+svymthRound
```

```
## 6    0.0117151185126433   0.00799217807522278   2.52085521254888     vil.id sex+wgt0+hgt0+svymthRound
## 7                     0  0.000728323735328998   594.262183761197        hgt sex+wgt0+hgt0+svymthRound
## 8                     0     0.352701518968252   538.353209678558        wgt sex+wgt0+hgt0+svymthRound
## 9  0.000447277200167272  0.000612792699568233   3.51088227277012     vil.id sex+wgt0+hgt0+svymthRound
## 10                    0   0.00331108017589107   277.738571133786        hgt sex+wgt0+hgt0+svymthRound
## 11                    0      1.25083486490652   164.368128386085        wgt sex+wgt0+hgt0+svymthRound
## 12 1.37139389802397e-18   0.00578476859618168  -8.80889965139067     vil.id sex+wgt0+hgt0+svymthRound
## 13                    0   0.00317113547025635   290.714194782148        hgt sex+wgt0+hgt0+svymthRound
## 14                    0      1.22639878616071   167.926734460268        wgt sex+wgt0+hgt0+svymthRound
## 15 7.79141497751766e-23   0.00565696328562864  -9.84988636256528     vil.id sex+wgt0+hgt0+svymthRound
##           wgt0_Pr...t..       wgt0_Std.Error       wgt0_tvalue         cal_Estimate          cal_Pr.
## 1     0.136011583497549 9.79994437486573e-05 -1.49087260496811                 <NA>
## 2  2.96480083692757e-63   0.0378027371614794  16.8512547316329                 <NA>
## 3  2.05763549729273e-06 0.000190221503167431 -4.74915073475531                 <NA>
## 4     0.230228828649018 9.74307633896921e-05 -1.19980821193398  0.00243408846205622 8.01672708877986
## 5  7.43034302413852e-66    0.037739875283113  17.2071051836606    0.699072500364623  4.7133190088529
## 6  6.66901196231733e-07 0.000189270503626621 -4.97244448929308 -0.00395676177098486  7.9464612402952
## 7  1.22269348058816e-13 0.000164767846917989  7.41843614592224                 <NA>
## 8  6.75367630221077e-62   0.0798131859486402  16.6477281392748                 <NA>
## 9  4.32675510884621e-09 0.000144040382619518   -5.872926128913                 <NA>
## 10 7.77000489086602e-07 9.90410500454311e-05 -4.94274682926991                 <NA>
## 11 7.42419220783427e-54   0.0374185042114355  15.5009805428138                 <NA>
## 12 1.40362012201826e-19 0.000172365145002826  -9.0619777654873                 <NA>
## 13    0.740027016459552 9.75208524392668e-05 0.331822524275644                 <NA>
## 14 4.09082062947785e-67   0.0377202854835204  17.3782370584956                 <NA>
## 15 2.75472781728448e-11 0.000173241059789276 -6.66312732777158                 <NA>
##    wealthIdx_Estimate    wealthIdx_Pr...t.. wealthIdx_Std.Error wealthIdx_tvalue    p.A.prot_Estimate
## 1                <NA>                 <NA>                <NA>             <NA>                 <NA>
## 2                <NA>                 <NA>                <NA>             <NA>                 <NA>
## 3                <NA>                 <NA>                <NA>             <NA>                 <NA>
## 4                <NA>                 <NA>                <NA>             <NA>                 <NA>
## 5                <NA>                 <NA>                <NA>             <NA>                 <NA>
## 6                <NA>                 <NA>                <NA>             <NA>                 <NA>
## 7    0.21045655488185  1.93494257274268e-41  0.0155791042075745  13.508899618216                 <NA>
## 8    106.678721085969   3.2548345535026e-45    7.54496977117083 14.1390521528113                 <NA>
## 9   0.451733304543324 4.82890644822007e-250  0.0132483771350785 34.0972558327347                 <NA>
## 10               <NA>                 <NA>                <NA>             <NA> 3.86952250259526e-05
## 11               <NA>                 <NA>                <NA>             <NA>  0.0052173129792458
## 12               <NA>                 <NA>                <NA>             <NA> 0.000149388430455141
## 13               <NA>                 <NA>                <NA>             <NA>                 <NA>
## 14               <NA>                 <NA>                <NA>             <NA>                 <NA>
## 15               <NA>                 <NA>                <NA>             <NA>                 <NA>
##     p.A.prot_tvalue  p.A.nProt_Estimate    p.A.nProt_Pr...t..  p.A.nProt_Std.Error p.A.nProt_tvalue
## 1              <NA>                <NA>                  <NA>                 <NA>             <NA>
## 2              <NA>                <NA>                  <NA>                 <NA>             <NA>
## 3              <NA>                <NA>                  <NA>                 <NA>             <NA>
## 4              <NA>                <NA>                  <NA>                 <NA>             <NA>
## 5              <NA>                <NA>                  <NA>                 <NA>             <NA>
## 6              <NA>                <NA>                  <NA>                 <NA>             <NA>
## 7              <NA>                <NA>                  <NA>                 <NA>             <NA>
## 8              <NA>                <NA>                  <NA>                 <NA>             <NA>
## 9              <NA>                <NA>                  <NA>                 <NA>             <NA>
## 10 3.83682180045518                <NA>                  <NA>                 <NA>             <NA>
## 11 1.36958319982295                <NA>                  <NA>                 <NA>             <NA>
```

```
## 12 8.45943342783186                <NA>                  <NA>                  <NA>             <NA>
## 13             <NA> 0.00542428867316449 5.25341325077391e-226 0.000166671307872964 32.5448257554855
## 14             <NA>   0.779514232050632  1.47950939943836e-33     0.06444313759758 12.0961557911467
## 15             <NA> 0.00526237555581024   3.7685780281174e-70 0.000295969260771016 17.7801422421419
```

```
vars.z <- c('indi.id')
ff_reg_mbyn(list.vars.y, list.vars.x,
            vars.c, vars.z, df,
            return_all = TRUE,
            stats_ends = 'Estimate')
```

Test Program IV Return All

```
## Warning: attributes are not identical across measure variables;
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```

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

```
##    X.Intercept._Estimate X.Intercept._Pr...z.. X.Intercept._Std.Error X.Intercept._zvalue     hgt0_Es
## 1       40.2173991882938  3.69748206920405e-59       2.47963650430699    16.2190704639323 0.40313972
## 2        1408.1626637032   0.00217397545504963       459.377029874119    3.06537456626657  35.576591
## 3       -64.490636067872  0.000109756271656929        16.673099250727   -3.86794531107106  1.2099506
## 4       39.6732302990235 1.30030240177373e-103       1.83545587849039    21.6149190857443 0.35797634
## 5       1325.54736576331   0.00138952700443324       414.645900526211    3.19681772828602  31.017270
## 6      -59.8304089440729  3.75547414421179e-07       11.7754321198995   -5.08095230263053   1.503744
## 7       35.5561817357046 2.01357089467444e-142       1.39936229104453    25.4088465605032 0.46043452
## 8        -2791.221534909  1.95034793045284e-05       653.605248808641   -4.27050048939585  59.154558
## 9       21.8005242861645  1.17899313785408e-34       1.77547715237629    12.2786847788984 0.41251213
## 10      24.3009261707644  1.97968607369592e-84        1.2481331128579    19.4698193008609 0.51579489
## 11     -499.067024090554     0.155922992163314       351.723712333143   -1.41891776582254  46.259161
## 12      21.4632286881661  1.84405333738942e-09       3.57067054655531    6.01097984491234 0.52081251
## 13       25.299209739617 1.29388565624566e-157      0.945826571474308     26.748254386829 0.51086868
## 14     -352.278518334717     0.287184942021997       330.990098562619    -1.0643173915611  45.565471
## 15      17.9359211844992  1.13855583530306e-12       2.52170174723203    7.11262590993832 0.53436210
##         hgt0_zvalue     prot_Estimate        prot_Pr...z..     prot_Std.Error       prot_zvalue Sarga
## 1  7.41136089709158 0.859205733632614 6.88427338202428e-19 0.0967928354481331  8.87674929300964
## 2  3.51137048180512  98.9428234201406 2.09631602352917e-08   17.6561952052848  5.60385871756365
## 3  3.29876072644971 -6.02451379136132 2.94171378745816e-20  0.653342710289155 -9.22106223347162
## 4  8.45373003027063              <NA>                 <NA>               <NA>              <NA>
## 5  3.21377335801252              <NA>                 <NA>               <NA>              <NA>
## 6  5.50460248701607              <NA>                 <NA>               <NA>              <NA>
## 7  12.7533216258548              <NA>                 <NA>               <NA>              <NA>
## 8  3.45880859967647              <NA>                 <NA>               <NA>              <NA>
## 9  9.21816552325528              <NA>                 <NA>               <NA>              <NA>
## 10 16.1673191711084              <NA>                 <NA>               <NA>              <NA>
## 11 5.13270005180026              <NA>                 <NA>               <NA>              <NA>
## 12 5.71448149208973              <NA>                 <NA>               <NA>              <NA>
## 13 21.4658243761363              <NA>                 <NA>               <NA>              <NA>
## 14 5.40878275196011              <NA>                 <NA>               <NA>              <NA>
## 15  8.4310762436216              <NA>                 <NA>               <NA>              <NA>
##     sexMale_Std.Error    sexMale_zvalue svymthRound_Estimate  svymthRound_Pr...z.. svymthRound_Std.Er
## 1   0.178475271469781  0.86310792817082     0.20990165085783   0.00846239710392287    0.079718317947
## 2    33.0216035385405  10.1085242471545      121.78985943172  5.96047652813855e-17      14.557708512
## 3    1.19371921154418  4.53352366774387     4.84745570027424  2.07373887977152e-19     0.538050140685
## 4   0.132821186086547 0.800381017440976    0.322893837128574  9.66146445882893e-11    0.049889691218
## 5    30.5174257711927  10.8283251459136     135.494858749214  4.48931446042076e-34       11.13348833
## 6   0.847955715223327  6.87676174970095     4.07024693316581  5.64723572160763e-36     0.325043349284
## 7   0.105343525210948   17.113904962338    0.433164820953121                     0   0.00120472816008
## 8    49.7632792630648  20.0498764266063      190.07735139541                     0     0.739269879490
## 9   0.132754263303719 -3.41102322376347   0.0137438264666969  1.57416908709431e-66  0.00079765593168
## 10 0.0945646985181925  10.8646912458831     1.00582859923509                     0   0.00746867714609
## 11   26.4822313532216  15.5336574870174     218.549980922774                     0       1.931571178
## 12  0.276250047248363 -2.85655126226267   -0.369567838754916 2.42696379701225e-102    0.017205698983
## 13 0.0675715533063635  15.0964658352764    0.929266902426869                     0   0.00539330635998
## 14   24.5920104216267  16.6647907361992     207.078222946319                     0      1.461678547
## 15   0.18692145837209 -3.99115565898846  -0.0985678389223824  1.84569897952709e-27   0.00907867488118
##                   vars_vars.c vars_vars.x vars_vars.z Weakinstruments_df1 Weakinstruments_df2 Weakins
## 1  sex+wgt0+hgt0+svymthRound        prot     indi.id                   1               18957    1.42
```

```
## 2  sex+wgt0+hgt0+svymthRound        prot     indi.id                  1              18962    4.45
## 3  sex+wgt0+hgt0+svymthRound        prot     indi.id                  1              18999    5.72
## 4  sex+wgt0+hgt0+svymthRound         cal     indi.id                  1              18957    1.77
## 5  sex+wgt0+hgt0+svymthRound         cal     indi.id                  1              18962    4.03
## 6  sex+wgt0+hgt0+svymthRound         cal     indi.id                  1              18999    5.47
## 7  sex+wgt0+hgt0+svymthRound   wealthIdx     indi.id                  1              25092
## 8  sex+wgt0+hgt0+svymthRound   wealthIdx     indi.id                  1              25102
## 9  sex+wgt0+hgt0+svymthRound   wealthIdx     indi.id                  1              30013
## 10 sex+wgt0+hgt0+svymthRound    p.A.prot     indi.id                  1              18587
## 11 sex+wgt0+hgt0+svymthRound    p.A.prot     indi.id                  1              18591
## 12 sex+wgt0+hgt0+svymthRound    p.A.prot     indi.id                  1              18845
## 13 sex+wgt0+hgt0+svymthRound   p.A.nProt     indi.id                  1              18587
## 14 sex+wgt0+hgt0+svymthRound   p.A.nProt     indi.id                  1              18591
## 15 sex+wgt0+hgt0+svymthRound   p.A.nProt     indi.id                  1              18845
##            wgt0_Estimate         wgt0_Pr...z..       wgt0_Std.Error       wgt0_zvalue Wu.Hausman_df1
## 1   -0.00163274724538111  4.88365163639597e-08  0.00029928487659495 -5.45549532591606              1
## 2      0.492582112313709  2.33136555228405e-20   0.0532753838702833  9.24596082710666              1
## 3    0.00999798623641602  7.95432753711715e-07  0.00202532507408065  4.93648469787221              1
## 4  -0.000658938519302931   0.00032843149807424 0.00018345755198560 -3.59177647456371              1
## 5      0.601258436431587   2.0921134733036e-48   0.0411255751282477  14.6200614716414              1
## 6    0.00326074237566435   0.00667886646012294  0.00120214094164169  2.71244598924594              1
## 7    0.00112485055604169  2.26123807446765e-11 0.00016818746785355  6.68807593334564              1
## 8       1.27282038539707  6.67525280062144e-56     0.08080475140115  15.7518012657231              1
## 9   -0.00512158791392237 6.51923753120087e-127 0.00021371531258907 -23.9645341827701              1
## 10  0.00071662891844493 2.43477572076212e-06 0.00015203699065892  4.71351685756907              1
## 11     0.761704518610475   8.2201479288098e-69   0.0434474820359048   17.531614789115              1
## 12  -0.00601345031606092  5.19751747217521e-44  0.00043218241369976 -13.9141485757875              1
## 13  0.00092210011725934 1.68237436753105e-15  0.00011580150512068  7.96276452796019              1
## 14     0.792700893714085  4.81415543564975e-82   0.0413159097814445  19.1863351892132              1
## 15  -0.00668277875606482 2.54848840100353e-105 0.00030660991918285 -21.7957030675165              1
##    Wu.Hausman_statistic       cal_Estimate         cal_Pr...z..       cal_Std.Error        cal_zvalu
## 1      543.467268879953               <NA>                 <NA>                <NA>             <NA
## 2      30.6481856102772               <NA>                 <NA>                <NA>             <NA
## 3      5652.51924792859               <NA>                 <NA>                <NA>             <NA
## 4      494.955883488045 0.0238724384575419 1.44956616452661e-33 0.00197718112735887  12.073976494723
## 5      24.4605456760994   2.71948246216953 9.21076021290446e-10   0.444177077282291   6.122518700894
## 6      5583.56513052781 -0.168054407187466 5.67614501764414e-39  0.0128692506794877 -13.058600797583
## 7      5.23078768861684               <NA>                 <NA>                <NA>             <NA
## 8       6.6473469952822               <NA>                 <NA>                <NA>             <NA
## 9      25949.7118056025               <NA>                 <NA>                <NA>             <NA
## 10     1119.87022468742               <NA>                 <NA>                <NA>             <NA
## 11     154.793296861581               <NA>                 <NA>                <NA>             <NA
## 12     4826.92242730041               <NA>                 <NA>                <NA>             <NA
## 13     494.903094649183               <NA>                 <NA>                <NA>             <NA
## 14      72.530787010352               <NA>                 <NA>                <NA>             <NA
## 15     7607.83405438193               <NA>                 <NA>                <NA>             <NA
##    wealthIdx_Std.Error  wealthIdx_zvalue    p.A.prot_Estimate     p.A.prot_Pr...z..   p.A.prot_Std.E
## 1                 <NA>              <NA>                 <NA>                 <NA>
## 2                 <NA>              <NA>                 <NA>                 <NA>
## 3                 <NA>              <NA>                 <NA>                 <NA>
## 4                 <NA>              <NA>                 <NA>                 <NA>
## 5                 <NA>              <NA>                 <NA>                 <NA>
## 6                 <NA>              <NA>                 <NA>                 <NA>
## 7   0.0312379492766376  4.62589553677969                 <NA>                 <NA>
```

```
## 8      13.358888551386  5.17869536991717                <NA>                  <NA>
## 9   0.0371054140359243 -51.5866689219593                <NA>                  <NA>
## 10                <NA>              <NA>  0.00148073028434642 2.50759287066563e-156 5.55884799941827
## 11                <NA>              <NA>    0.221916473012486  8.30126393398654e-33   0.018602236956
## 12                <NA>              <NA> -0.00520794333267238 3.00201194005694e-197 0.000173813943639
## 13                <NA>              <NA>                <NA>                  <NA>
## 14                <NA>              <NA>                <NA>                  <NA>
## 15                <NA>              <NA>                <NA>                  <NA>
##       p.A.nProt_Pr...z..  p.A.nProt_Std.Error  p.A.nProt_zvalue
## 1                   <NA>                <NA>              <NA>
## 2                   <NA>                <NA>              <NA>
## 3                   <NA>                <NA>              <NA>
## 4                   <NA>                <NA>              <NA>
## 5                   <NA>                <NA>              <NA>
## 6                   <NA>                <NA>              <NA>
## 7                   <NA>                <NA>              <NA>
## 8                   <NA>                <NA>              <NA>
## 9                   <NA>                <NA>              <NA>
## 10                  <NA>                <NA>              <NA>
## 11                  <NA>                <NA>              <NA>
## 12                  <NA>                <NA>              <NA>
## 13 2.61782083774363e-226 0.000440019589949091  32.1162192385744
## 14  4.81511329043196e-35     0.17153115470458  12.3509307017263
## 15                     0  0.00128926108222202 -38.3528894620707
```

Program Line by Line Set Up Parameters

```
vars.z <- c('indi.id')
vars.z <- NULL
vars.c <- c('sex', 'wgt0', 'hgt0', 'svymthRound')
```

```
df.reg.out <- as_tibble(bind_rows(lapply(list.vars.y, regf.iv, vars.x=var.x1, vars.c=vars.c, vars.z=vars
```

Lapply

```
lapply(list.vars.y, function(y) (mean(df[[var.x1]], na.rm=TRUE) + mean(df[[y]], na.rm=TRUE)))
```

Nested Lapply Test

```
## [[1]]
## [1] 98.3272
##
## [[2]]
## [1] 13626.51
##
## [[3]]
## [1] 26.11226
```

```
lapplytwice <- lapply(list.vars.x, function(x) (lapply(list.vars.y, function(y) (mean(df[[x]], na.rm=TRU
lapplytwice
```

```
## [[1]]
## [[1]][[1]]
## [1] 98.3272
```

```
##
## [[1]][[2]]
## [1] 13626.51
##
## [[1]][[3]]
## [1] 26.11226
##
##
## [[2]]
## [[2]][[1]]
## [1] 525.4708
##
## [[2]][[2]]
## [1] 14053.65
##
## [[2]][[3]]
## [1] 453.2558
##
##
## [[3]]
## [[3]][[1]]
## [1] 90.69287
##
## [[3]][[2]]
## [1] 13618.87
##
## [[3]][[3]]
## [1] 18.47793
##
##
## [[4]]
## [[4]][[1]]
## [1] 2095.3
##
## [[4]][[2]]
## [1] 15623.48
##
## [[4]][[3]]
## [1] 2023.085
##
##
## [[5]]
## [[5]][[1]]
## [1] 271.2886
##
## [[5]][[2]]
## [1] 13799.47
##
## [[5]][[3]]
## [1] 199.0737
```

```
df.reg.out.all <- bind_rows(lapply(list.vars.x,
                      function(x) (
```

```
                        bind_rows(lapply(list.vars.y, regf.iv, vars.x=x, vars.c=vars.c, vars.z=vars.z
                    )))
```

```
df.reg.out.all
```

Nested Lapply All

```
##    X.Intercept._Estimate X.Intercept._Pr...t.. X.Intercept._Std.Error X.Intercept._tvalue    adj.r.s
## 1       27.3528514188608 5.68247182214952e-231      0.831272666092284    32.9047886867776  0.8142490
## 2        99.873884728925      0.75529705553815       320.450650378664    0.31166697465244   0.607169
## 3       31.4646660224049  6.78164655340399e-84       1.61328519718754     19.503474077155 0.0373247
## 4       27.9038445914729 8.24252673989353e-242      0.828072565159449    33.6973421962119   0.816089
## 5       219.626705179399     0.493216914827181       320.522532223672   0.685214557790078  0.6078636
## 6       30.5103987898551  1.62608789535248e-79       1.60831193651104    18.9704485163756 0.0453498
## 7       35.7840188807906 2.26726906489443e-145       1.38461348429899    25.8440491058106  0.9350149
## 8      -2662.74787734003  7.13318862990131e-05       670.301542938561   -3.97246270039407   0.921936
## 9       29.2381039651127 1.53578035267873e-124       1.22602177264147    23.8479483950102  0.0595431
## 10      23.9948407749744 2.11912344053336e-165       0.86658104216672    27.6890903532576  0.8146908
## 11     -547.959546430028    0.0941551350855875       327.343126852912    -1.6739607509042  0.6173005
## 12      22.3367814226238  3.04337266226599e-49        1.5098937308759    14.7936116071335 0.0261131
## 13      24.4904444950827 2.34941965806705e-181      0.843371070670838    29.0387533397398  0.8245423
## 14     -476.703973630552     0.143844033032183       326.132837036936   -1.46168652614567  0.6202507
## 15      22.7781908464511  9.58029450711211e-52        1.5004526558957    15.1808794212527 0.0385437
##            hgt0_Pr...t..      hgt0_Std.Error       hgt0_tvalue       prot_Estimate        prot_Pr...t
## 1  1.14533314566771e-183 0.0206657538633713  29.2231378249683   0.049431093806755 9.54769322304645e-
## 2   1.52417506966835e-12   7.96735224000553   7.0770314931977    16.5557424523585 9.61203373222183e-
## 3   1.40290395213743e-13 0.0401060913799595 -7.40147890309685 -0.0758835879205584 3.56396093562335e-
## 4  7.79174951119325e-177 0.0205836398278421  28.6561486875877                <NA>                <NA
## 5   3.05720143843395e-11   7.96822145797115  6.64774497790599                <NA>                <NA
## 6   8.49149153665126e-12 0.0399777363511633 -6.83428417151858                <NA>                <NA
## 7   2.71000479249152e-36 0.0348701896610764  12.6002885423502                <NA>                <NA
## 8    0.00520266507060071   16.8823489375743  2.79445531182864                <NA>                <NA
## 9   2.41020063623865e-31 0.0307984635553859  -11.659076407325                <NA>                <NA
## 10 1.31914432912869e-220 0.0213841849324282  32.1391351404584                <NA>                <NA
## 11  4.78613024244006e-19   8.07744906400683  8.92677379355593                <NA>                <NA
## 12    0.0034801146146182 0.0372288594891345 -2.92217281443323                <NA>                <NA
## 13 1.11511327164938e-190 0.0208846437570215  29.8015803204665                <NA>                <NA
## 14  8.38546282719268e-15   8.07589192978212  7.76801157994423                <NA>                <NA
## 15  2.13723119924676e-05 0.0371223237183417 -4.25112470577158                <NA>                <NA
##           r.squared_v   sexMale_Estimate     sexMale_Pr...t..  sexMale_Std.Error    sexMale_tvalue
## 1   0.814298005954592  0.935177182449406 2.36432111724607e-51 0.0618482294097262  15.1205166481668 4
## 2   0.607272921412825   415.163616765357 2.48252880290814e-67   23.8518341439675  17.4059409544552 1
## 3  0.0375780335372857 -0.254089999175318   0.0343768259467621  0.120093045309631 -2.11577613441484 8
## 4   0.816137722617266  0.893484662055608 2.08765935335877e-47 0.0616078355613525  14.5027763743757 4
## 5    0.60796705182314   405.534891838028 2.51355675686752e-64   23.8567507583516  16.9987478993157 1
## 6  0.0456010419476623 -0.181389489610951    0.129768754080748   0.11972270545355 -1.51508010885476 8
## 7    0.93502787877066   1.80682463132073 1.26527362032354e-66  0.104475287357902  17.2942776901016 8
## 8   0.921952383432195   999.926876716707 2.64630894140004e-86   50.5879876531386  19.7660931597596 3
## 9  0.0596997716363463  -0.33436777751525 0.000311174554787706 0.0927193334338799 -3.60623577771614 7
## 10  0.814740639193486  0.932686930233136 7.90489020586094e-47 0.0647209948973267  14.4108867873979 4
## 11  0.617403496088206   397.141948675354 6.19449742677662e-59   24.4473730956481  16.2447698213453 1
## 12 0.0263714328556815 -0.445232370681998 7.93666802281971e-05  0.112797805327952 -3.94717228218682
## 13  0.824589538985803   0.96466980500711 1.24556615236597e-52 0.0629827627260302   15.316409812052 4
## 14  0.620352835549783    401.59056368102 1.18469030741261e-60   24.3549086073387  16.4891016491029 1
```

```
## 15 0.0387987636986586 -0.423829627017582  0.00015644693636154  0.112083516545945 -3.78137339083082 7
##    svymthRound_Pr...t.. svymthRound_Std.Error svymthRound_tvalue vars_var.y               vars_vars.
## 1                     0   0.00387681209575621   224.840892330022        hgt sex+wgt0+hgt0+svymthRound
## 2                     0       1.4955473831309   126.403823119306        wgt sex+wgt0+hgt0+svymthRound
## 3    0.0397984032097113   0.00752730297891317  -2.05597660181154     vil.id sex+wgt0+hgt0+svymthRound
## 4                     0   0.00411253488213795   207.168832400006        hgt sex+wgt0+hgt0+svymthRound
## 5                     0      1.59266949679221   116.357025971267        wgt sex+wgt0+hgt0+svymthRound
## 6    0.0117151185126433   0.00799217807522278   2.52085521254888     vil.id sex+wgt0+hgt0+svymthRound
## 7                     0  0.000728323735328998   594.262183761197        hgt sex+wgt0+hgt0+svymthRound
## 8                     0     0.352701518968252   538.353209678558        wgt sex+wgt0+hgt0+svymthRound
## 9  0.000447277200167272  0.000612792699568233   3.51088227277012     vil.id sex+wgt0+hgt0+svymthRound
## 10                    0   0.00331108017589107   277.738571133786        hgt sex+wgt0+hgt0+svymthRound
## 11                    0      1.25083486490652   164.368128386085        wgt sex+wgt0+hgt0+svymthRound
## 12 1.37139389802397e-18   0.00578476859618168  -8.80889965139067     vil.id sex+wgt0+hgt0+svymthRound
## 13                    0   0.00317113547025635   290.714194782148        hgt sex+wgt0+hgt0+svymthRound
## 14                    0      1.22639878616071   167.926734460268        wgt sex+wgt0+hgt0+svymthRound
## 15 7.79141497751766e-23   0.00565696328562864  -9.84988636256528     vil.id sex+wgt0+hgt0+svymthRound
##           wgt0_Pr...t..       wgt0_Std.Error       wgt0_tvalue         cal_Estimate          cal_Pr.
## 1     0.136011583497549 9.79994437486573e-05 -1.49087260496811                 <NA>
## 2  2.96480083692757e-63   0.0378027371614794  16.8512547316329                 <NA>
## 3  2.05763549729273e-06 0.000190221503167431 -4.74915073475531                 <NA>
## 4     0.230228828649018 9.74307633896921e-05 -1.19980821193398  0.00243408846205622 8.01672708877986
## 5  7.43034302413852e-66    0.037739875283113  17.2071051836606    0.699072500364623  4.7133190088529
## 6  6.66901196231733e-07 0.000189270503626621 -4.97244448929308 -0.00395676177098486  7.9464612402952
## 7  1.22269348058816e-13 0.000164767846917989  7.41843614592224                 <NA>
## 8  6.75367630221077e-62   0.0798131859486402  16.6477281392748                 <NA>
## 9  4.32675510884621e-09 0.000144040382619518   -5.872926128913                 <NA>
## 10 7.77000489086602e-07 9.90410500454311e-05 -4.94274682926991                 <NA>
## 11 7.42419220783427e-54   0.0374185042114355  15.5009805428138                 <NA>
## 12 1.40362012201826e-19 0.000172365145002826  -9.0619777654873                 <NA>
## 13    0.740027016459552 9.75208524392668e-05 0.331822524275644                 <NA>
## 14 4.09082062947785e-67   0.0377202854835204  17.3782370584956                 <NA>
## 15 2.75472781728448e-11 0.000173241059789276 -6.66312732777158                 <NA>
##    wealthIdx_Estimate    wealthIdx_Pr...t.. wealthIdx_Std.Error wealthIdx_tvalue    p.A.prot_Estimat
## 1                <NA>                  <NA>                <NA>             <NA>                 <NA
## 2                <NA>                  <NA>                <NA>             <NA>                 <NA
## 3                <NA>                  <NA>                <NA>             <NA>                 <NA
## 4                <NA>                  <NA>                <NA>             <NA>                 <NA
## 5                <NA>                  <NA>                <NA>             <NA>                 <NA
## 6                <NA>                  <NA>                <NA>             <NA>                 <NA
## 7    0.21045655488185  1.93494257274268e-41  0.0155791042075745  13.508899618216                 <NA
## 8    106.678721085969   3.2548345535026e-45    7.54496977117083 14.1390521528113                 <NA
## 9   0.451733304543324 4.82890644822007e-250  0.0132483771350785 34.0972558327347                 <NA
## 10               <NA>                  <NA>                <NA>             <NA> 3.86952250259526e-05
## 11               <NA>                  <NA>                <NA>             <NA>  0.0052173129792458
## 12               <NA>                  <NA>                <NA>             <NA> 0.00014938843045514
## 13               <NA>                  <NA>                <NA>             <NA>                 <NA
## 14               <NA>                  <NA>                <NA>             <NA>                 <NA
## 15               <NA>                  <NA>                <NA>             <NA>                 <NA
##     p.A.prot_tvalue  p.A.nProt_Estimate    p.A.nProt_Pr...t..  p.A.nProt_Std.Error p.A.nProt_tvalue
## 1              <NA>                <NA>                  <NA>                 <NA>            <NA>
## 2              <NA>                <NA>                  <NA>                 <NA>            <NA>
## 3              <NA>                <NA>                  <NA>                 <NA>            <NA>
## 4              <NA>                <NA>                  <NA>                 <NA>            <NA>
```

```
## 5              <NA>                <NA>                  <NA>                 <NA>             <NA>
## 6              <NA>                <NA>                  <NA>                 <NA>             <NA>
## 7              <NA>                <NA>                  <NA>                 <NA>             <NA>
## 8              <NA>                <NA>                  <NA>                 <NA>             <NA>
## 9              <NA>                <NA>                  <NA>                 <NA>             <NA>
## 10 3.83682180045518                <NA>                  <NA>                 <NA>             <NA>
## 11 1.36958319982295                <NA>                  <NA>                 <NA>             <NA>
## 12 8.45943342783186                <NA>                  <NA>                 <NA>             <NA>
## 13             <NA> 0.00542428867316449 5.25341325077391e-226 0.000166671307872964 32.5448257554855
## 14             <NA>   0.779514232050632  1.47950939943836e-33     0.06444313759758 12.0961557911467
## 15             <NA> 0.00526237555581024   3.7685780281174e-70 0.000295969260771016 17.7801422421419
```

```
df.reg.out.all <- (lapply(list.vars.x,
                      function(x) (
                          bind_rows(lapply(list.vars.y, regf.iv, vars.x=x, vars.c=vars.c, vars.z=vars.z
                              select(vars_var.y, starts_with(x)) %>%
                              select(vars_var.y, ends_with('value'))
                      ))) %>% reduce(full_join)
```

Nested Lapply Select

```
## Joining, by = "vars_var.y"Joining, by = "vars_var.y"Joining, by = "vars_var.y"Joining, by = "vars_va
```

```
df.reg.out.all
```

```
##   vars_var.y       prot_tvalue        cal_tvalue wealthIdx_tvalue  p.A.prot_tvalue p.A.nProt_tvalue
## 1        hgt  18.8756010031786  23.4421863484661  13.508899618216 3.83682180045518 32.5448257554855
## 2        wgt  16.3591125056062  17.3686031309332 14.1390521528113 1.36958319982295 12.0961557911467
## 3     vil.id -14.9385580468907 -19.6150110809452 34.0972558327347 8.45943342783186 17.7801422421419
```