# HW1

## Erik Andersen

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```r
# Load packages
pacman::p_load(tidyverse, here, haven, magrittr)

# Load data
burk_df = read_dta(here("HW1", "data", "burkina731.dta"))

# Change appropriate variables to factors
burk_df %<>% mutate(village = as.factor(village),
                    year = as.factor(year),
                    fcrop = as.factor(fcrop),
                    hhn = as.factor(hhn),
                    hhn_unique = hhn:village)
```

**Question 4**

```r
# We're doing this cumbersome method to put the formula in because I thought it was cool, but mostly be

# Get vector of all control variables for ease of use
x = c(grep('soil', names(burk_df), value = TRUE), grep('topo', names(burk_df), value = TRUE), grep('loc

# Add village fixed effects
village = c(x, "village*year*fcrop")

# Function that outputs regression formula
formula_generator = function(y = "lnvalue", x){
  a = paste(y, "~", sep = " ")
  paste(a, paste(paste0(x),  collapse = " + ")) |> as.formula()
}

# Village fixed effects formula
village_formula = formula_generator('lnvalue', village)
# Estimate first regression.
village_reg = lm(village_formula, burk_df)


# Now add household fixed effects
household = c(x, "hhn*year*fcrop")

# Formula
household_formula = formula_generator('lnvalue', household)
```
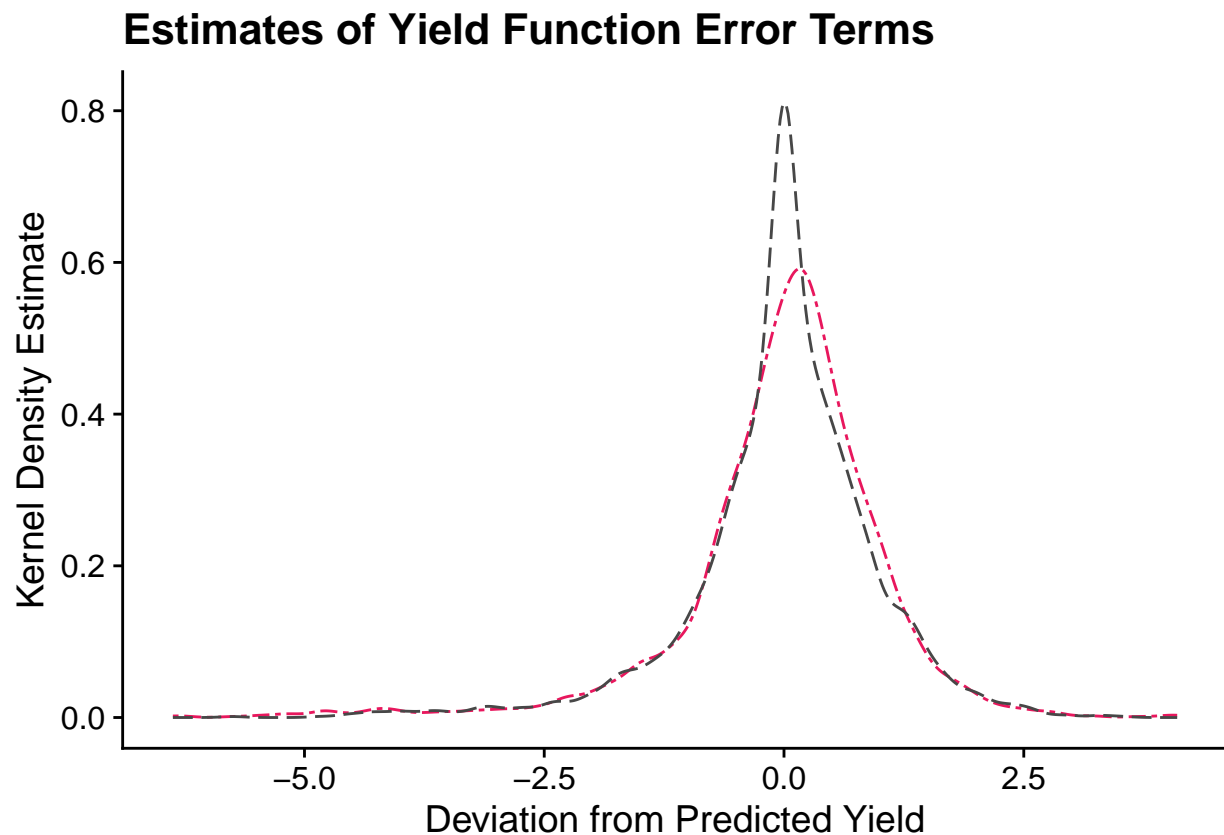
```r
# Regression
household_reg = lm(household_formula, data = burk_df)

# Graph the density of residuals from each regression
resids = tibble(village = village_reg$residuals, household = household_reg$residuals)

# Graph residuals
resids |>
  ggplot(aes(village)) +
  geom_density(col = '#E8175D', linetype = "twodash") +
  geom_density(aes(x = household), col = '#474747', linetype = 'longdash') +
  xlab("Deviation from Predicted Yield") +  ylab("Kernel Density Estimate") +
  ggtitle("Estimates of Yield Function Error Terms") +
  cowplot::theme_cowplot()
```



```r
# Test if distributions are different using KS test
with(resids, ks.test(village, household)) # Reject
```

```
## Warning in ks.test.default(village, household): p-value will be approximate in
## the presence of ties
```

```
## 
##  Asymptotic two-sample Kolmogorov-Smirnov test
## 
```

```
## data:  village and household
## D = 0.078416, p-value = 2.641e-07
## alternative hypothesis: two-sided
```

**Question 5**

```r
# Add log of hh size of other plots to data
hhsize = c("lnhhsize", x, "village*year*fcrop")

# Formula
hhsize_formula = formula_generator('lnvalue', hhsize)
# Run regression
other_reg = lm(hhsize_formula, burk_df)
summary(other_reg)
```

```
##
## Call:
## lm(formula = hhsize_formula, data = burk_df)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -6.0872 -0.3911  0.1214  0.5671  3.9816
##
## Coefficients: (226 not defined because of singularities)
##                   Estimate Std. Error t value Pr(>|t|)
## (Intercept)       2.953932   0.303290   9.740  < 2e-16 ***
## lnhhsize          0.174497   0.040388   4.320 1.63e-05 ***
## soil7            -0.185085   0.138588  -1.336 0.181857
## soil21            0.334016   0.218695   1.527 0.126833
## soil31            0.094384   0.160900   0.587 0.557537
## soil32           -0.020781   0.163379  -0.127 0.898799
## soil33            0.157360   0.219685   0.716 0.473888
## soil37            0.139808   0.208954   0.669 0.503513
## soil35            0.037521   0.292574   0.128 0.897967
## soil45            0.025093   0.172441   0.146 0.884316
## soil51            0.116734   0.098102   1.190 0.234212
## soil1             0.130808   0.463260   0.282 0.777693
## soil3            -0.152436   0.134633  -1.132 0.257666
## soil11           -0.299804   0.252798  -1.186 0.235780
## soil12            0.008792   0.239190   0.037 0.970681
## soil13            0.326383   0.293937   1.110 0.266961
## soil34           -0.361505   0.359567  -1.005 0.314826
## soil46           -0.315251   0.257260  -1.225 0.220556
## soil53            0.400923   0.216994   1.848 0.064798 .
## topo1            -0.475164   0.166265  -2.858 0.004307 **
## topo2            -0.316018   0.149974  -2.107 0.035223 *
## topo3            -0.282483   0.147303  -1.918 0.055285 .
## topo4            -0.233111   0.145424  -1.603 0.109092
## loc1              0.192384   0.083745   2.297 0.021702 *
## loc2              0.108107   0.062054   1.742 0.081629 .
## lnarea            0.801600   0.027597  29.047  < 2e-16 ***
## village2          0.108706   0.268282   0.405 0.685376
```

```
## village3            0.038698   0.380412   0.102 0.918984
## village4           -0.405748   0.372149  -1.090 0.275715
## village5            0.210414   0.366856   0.574 0.566327
## village6            0.601326   0.422008   1.425 0.154331
## year2              -0.982707   0.300866  -3.266 0.001107 **
## year3               0.159812   0.303215   0.527 0.598210
## fcrop2             -0.345452   0.483096  -0.715 0.474640
## fcrop3             -1.233119   0.370490  -3.328 0.000889 ***
## fcrop4             -1.141998   0.692329  -1.650 0.099195 .
## fcrop5             -0.195300   0.359296  -0.544 0.586799
## fcrop6              0.649245   0.728340   0.891 0.372815
## fcrop7              0.256602   0.429803   0.597 0.550557
## fcrop8             -0.904873   0.684087  -1.323 0.186064
## fcrop9             -1.834625   0.709061  -2.587 0.009737 **
## fcrop11            -2.189504   0.544132  -4.024 5.93e-05 ***
## fcrop12            -0.101127   0.818696  -0.124 0.901706
## fcrop15             0.553959   1.161226   0.477 0.633379
## fcrop16            -2.795806   0.846429  -3.303 0.000972 ***
## fcrop18             0.021861   1.148197   0.019 0.984811
## fcrop20            -2.163290   0.646011  -3.349 0.000826 ***
## fcrop22            -2.375288   0.837037  -2.838 0.004587 **
## fcrop24            -1.580683   1.130724  -1.398 0.162279
## fcrop25            -2.947858   1.150958  -2.561 0.010500 *
## fcrop31             0.068667   0.353733   0.194 0.846100
## fcrop32            -1.817951   1.127860  -1.612 0.107143
## fcrop44             1.563614   0.607135   2.575 0.010081 *
## village2:year2      0.047261   0.376919   0.125 0.900228
## village3:year2     -0.001006   0.393878  -0.003 0.997963
## village4:year2      0.955184   0.411286   2.322 0.020305 *
## village5:year2     -0.095954   0.409053  -0.235 0.814561
## village6:year2     -0.572311   0.502577  -1.139 0.254936
## village2:year3     -0.390616   0.374217  -1.044 0.296689
## village3:year3           NA         NA      NA       NA
## village4:year3      0.033092   0.407388   0.081 0.935267
## village5:year3           NA         NA      NA       NA
## village6:year3     -0.601841   0.499380  -1.205 0.228271
## village2:fcrop2     0.470685   0.572054   0.823 0.410717
## village3:fcrop2     0.980590   0.492037   1.993 0.046400 *
## village4:fcrop2     0.347717   0.549557   0.633 0.526984
## village5:fcrop2     0.582572   0.482452   1.208 0.227368
## village6:fcrop2     0.069251   0.605607   0.114 0.908971
## village2:fcrop3           NA         NA      NA       NA
## village3:fcrop3     0.279897   0.485219   0.577 0.564105
## village4:fcrop3     1.612200   0.560670   2.875 0.004075 **
## village5:fcrop3     0.145632   0.469405   0.310 0.756404
## village6:fcrop3           NA         NA      NA       NA
## village2:fcrop4    -1.835730   1.310690  -1.401 0.161487
## village3:fcrop4     0.416641   0.824826   0.505 0.613523
## village4:fcrop4     0.989085   0.899021   1.100 0.271380
## village5:fcrop4           NA         NA      NA       NA
## village6:fcrop4     1.138860   1.071779   1.063 0.288091
## village2:fcrop5    -0.639217   0.425086  -1.504 0.132801
## village3:fcrop5    -0.728754   0.451091  -1.616 0.106345
## village4:fcrop5     1.190194   0.453812   2.623 0.008788 **
```

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```
## village5:fcrop5     -0.816379   0.445720   -1.832 0.067154 .
## village6:fcrop5      1.795962   0.506120    3.548 0.000396 ***
## village2:fcrop6     -0.933022   0.880717   -1.059 0.289545
## village3:fcrop6      0.256922   1.218872    0.211 0.833074
## village4:fcrop6     -0.019129   1.216545   -0.016 0.987456
## village5:fcrop6      0.821994   0.732843    1.122 0.262140
## village6:fcrop6           NA         NA       NA       NA
## village2:fcrop7      0.533608   0.533845    1.000 0.317641
## village3:fcrop7           NA         NA       NA       NA
## village4:fcrop7           NA         NA       NA       NA
## village5:fcrop7           NA         NA       NA       NA
## village6:fcrop7           NA         NA       NA       NA
## village2:fcrop8      1.155532   0.807472    1.431 0.152565
## village3:fcrop8      0.487417   1.016036    0.480 0.631474
## village4:fcrop8      1.722305   0.748126    2.302 0.021424 *
## village5:fcrop8     -0.643196   0.968478   -0.664 0.506680
## village6:fcrop8      0.360760   0.798826    0.452 0.651595
## village2:fcrop9      1.304949   1.323397    0.986 0.324218
## village3:fcrop9           NA         NA       NA       NA
## village4:fcrop9           NA         NA       NA       NA
## village5:fcrop9     -1.340424   0.799997   -1.676 0.093978 .
## village6:fcrop9           NA         NA       NA       NA
## village2:fcrop11          NA         NA       NA       NA
## village3:fcrop11          NA         NA       NA       NA
## village4:fcrop11          NA         NA       NA       NA
## village5:fcrop11     0.131946   1.221324    0.108 0.913978
## village6:fcrop11          NA         NA       NA       NA
## village2:fcrop12     1.020103   1.038275    0.982 0.325968
## village3:fcrop12          NA         NA       NA       NA
## village4:fcrop12          NA         NA       NA       NA
## village5:fcrop12    -4.880239   1.366113   -3.572 0.000362 ***
## village6:fcrop12    -2.495663   0.993539   -2.512 0.012083 *
## village2:fcrop15          NA         NA       NA       NA
## village3:fcrop15     3.656412   1.342439    2.724 0.006509 **
## village4:fcrop15     0.798456   1.220442    0.654 0.513032
## village5:fcrop15     0.708707   1.702546    0.416 0.677260
## village6:fcrop15          NA         NA       NA       NA
## village2:fcrop16          NA         NA       NA       NA
## village3:fcrop16     3.894919   1.274716    3.056 0.002275 **
## village4:fcrop16          NA         NA       NA       NA
## village5:fcrop16          NA         NA       NA       NA
## village6:fcrop16          NA         NA       NA       NA
## village2:fcrop18          NA         NA       NA       NA
## village3:fcrop18          NA         NA       NA       NA
## village4:fcrop18          NA         NA       NA       NA
## village5:fcrop18    -2.362589   1.398188   -1.690 0.091225 .
## village6:fcrop18          NA         NA       NA       NA
## village2:fcrop20          NA         NA       NA       NA
## village3:fcrop20          NA         NA       NA       NA
## village4:fcrop20          NA         NA       NA       NA
## village5:fcrop20          NA         NA       NA       NA
## village6:fcrop20          NA         NA       NA       NA
## village2:fcrop22     3.032914   0.945903    3.206 0.001364 **
## village3:fcrop22          NA         NA       NA       NA
```

```
## village4:fcrop22            NA         NA     NA       NA
## village5:fcrop22      4.589952   1.607105  2.856 0.004332 **
## village6:fcrop22            NA         NA     NA       NA
## village2:fcrop24            NA         NA     NA       NA
## village3:fcrop24            NA         NA     NA       NA
## village4:fcrop24            NA         NA     NA       NA
## village5:fcrop24            NA         NA     NA       NA
## village6:fcrop24            NA         NA     NA       NA
## village2:fcrop25            NA         NA     NA       NA
## village3:fcrop25            NA         NA     NA       NA
## village4:fcrop25            NA         NA     NA       NA
## village5:fcrop25            NA         NA     NA       NA
## village6:fcrop25            NA         NA     NA       NA
## village2:fcrop31            NA         NA     NA       NA
## village3:fcrop31     -0.967722   1.167198 -0.829 0.407143
## village4:fcrop31            NA         NA     NA       NA
## village5:fcrop31     -0.168506   0.400410 -0.421 0.673920
## village6:fcrop31            NA         NA     NA       NA
## village2:fcrop32            NA         NA     NA       NA
## village3:fcrop32            NA         NA     NA       NA
## village4:fcrop32            NA         NA     NA       NA
## village5:fcrop32            NA         NA     NA       NA
## village6:fcrop32            NA         NA     NA       NA
## village2:fcrop44            NA         NA     NA       NA
## village3:fcrop44            NA         NA     NA       NA
## village4:fcrop44            NA         NA     NA       NA
## village5:fcrop44      1.541424   1.054063  1.462 0.143792
## village6:fcrop44            NA         NA     NA       NA
## year2:fcrop2         -0.301763   0.620645 -0.486 0.626870
## year3:fcrop2         -0.239410   0.591513 -0.405 0.685709
## year2:fcrop3          1.327225   0.504535  2.631 0.008586 **
## year3:fcrop3          1.201958   0.531331  2.262 0.023789 *
## year2:fcrop4                NA         NA     NA       NA
## year3:fcrop4                NA         NA     NA       NA
## year2:fcrop5          0.039560   0.495595  0.080 0.936385
## year3:fcrop5          1.311789   0.484244  2.709 0.006805 **
## year2:fcrop6         -0.332435   0.830848 -0.400 0.689113
## year3:fcrop6         -0.053435   0.820579 -0.065 0.948086
## year2:fcrop7          0.402674   1.198518  0.336 0.736922
## year3:fcrop7          1.218601   1.196341  1.019 0.308508
## year2:fcrop8          0.898855   0.582476  1.543 0.122942
## year3:fcrop8          1.064320   0.573605  1.855 0.063666 .
## year2:fcrop9          2.867053   0.931644  3.077 0.002115 **
## year3:fcrop9          1.195069   0.895198  1.335 0.182029
## year2:fcrop11         1.671990   0.730497  2.289 0.022188 *
## year3:fcrop11         1.278666   0.728114  1.756 0.079212 .
## year2:fcrop12         1.798733   1.001717  1.796 0.072695 .
## year3:fcrop12         1.982637   1.001160  1.980 0.047796 *
## year2:fcrop15         0.752099   1.623522  0.463 0.643232
## year3:fcrop15        -2.905148   0.579131 -5.016 5.71e-07 ***
## year2:fcrop16         1.412678   1.409065  1.003 0.316187
## year3:fcrop16         0.209595   1.581175  0.133 0.894557
## year2:fcrop18         2.664505   1.133559  2.351 0.018837 *
## year3:fcrop18               NA         NA     NA       NA
```

```
## year2:fcrop20         2.464977   0.881292   2.797 0.005205 **
## year3:fcrop20               NA         NA      NA       NA
## year2:fcrop22         1.138841   1.402733   0.812 0.416957
## year3:fcrop22         0.219825   1.208462   0.182 0.855675
## year2:fcrop24         3.322126   1.594384   2.084 0.037314 *
## year3:fcrop24               NA         NA      NA       NA
## year2:fcrop25               NA         NA      NA       NA
## year3:fcrop25               NA         NA      NA       NA
## year2:fcrop31         1.221157   0.458757   2.662 0.007830 **
## year3:fcrop31         0.371342   0.460939   0.806 0.420553
## year2:fcrop32               NA         NA      NA       NA
## year3:fcrop32               NA         NA      NA       NA
## year2:fcrop44         0.430577   0.742038   0.580 0.561799
## year3:fcrop44        -2.768646   0.903068  -3.066 0.002198 **
## village2:year2:fcrop2  0.111006   0.785586   0.141 0.887644
## village3:year2:fcrop2  0.278377   0.657388   0.423 0.672004
## village4:year2:fcrop2  0.844562   0.715213   1.181 0.237795
## village5:year2:fcrop2  0.022628   0.662856   0.034 0.972771
## village6:year2:fcrop2  0.872929   0.792690   1.101 0.270926
## village2:year3:fcrop2  0.003649   0.811122   0.004 0.996411
## village3:year3:fcrop2        NA         NA      NA       NA
## village4:year3:fcrop2  0.367096   0.687529   0.534 0.593443
## village5:year3:fcrop2        NA         NA      NA       NA
## village6:year3:fcrop2  0.642734   0.768501   0.836 0.403055
## village2:year2:fcrop3        NA         NA      NA       NA
## village3:year2:fcrop3  0.541641   0.662534   0.818 0.413719
## village4:year2:fcrop3 -1.045578   0.782554  -1.336 0.181658
## village5:year2:fcrop3  0.510842   0.672862   0.759 0.447814
## village6:year2:fcrop3        NA         NA      NA       NA
## village2:year3:fcrop3        NA         NA      NA       NA
## village3:year3:fcrop3        NA         NA      NA       NA
## village4:year3:fcrop3 -1.489607   0.766694  -1.943 0.052163 .
## village5:year3:fcrop3        NA         NA      NA       NA
## village6:year3:fcrop3        NA         NA      NA       NA
## village2:year2:fcrop4        NA         NA      NA       NA
## village3:year2:fcrop4        NA         NA      NA       NA
## village4:year2:fcrop4        NA         NA      NA       NA
## village5:year2:fcrop4        NA         NA      NA       NA
## village6:year2:fcrop4        NA         NA      NA       NA
## village2:year3:fcrop4        NA         NA      NA       NA
## village3:year3:fcrop4        NA         NA      NA       NA
## village4:year3:fcrop4        NA         NA      NA       NA
## village5:year3:fcrop4        NA         NA      NA       NA
## village6:year3:fcrop4        NA         NA      NA       NA
## village2:year2:fcrop5 -0.509025   0.624077  -0.816 0.414796
## village3:year2:fcrop5  2.217819   0.636382   3.485 0.000502 ***
## village4:year2:fcrop5  0.099616   0.644718   0.155 0.877222
## village5:year2:fcrop5  2.091436   0.643832   3.248 0.001179 **
## village6:year2:fcrop5 -0.805097   0.686271  -1.173 0.240870
## village2:year3:fcrop5 -1.777937   0.605533  -2.936 0.003359 **
## village3:year3:fcrop5        NA         NA      NA       NA
## village4:year3:fcrop5 -1.927500   0.625309  -3.082 0.002080 **
## village5:year3:fcrop5        NA         NA      NA       NA
## village6:year3:fcrop5 -2.722996   0.671963  -4.052 5.26e-05 ***
```

```
## village2:year2:fcrop6    0.429425   1.120845   0.383 0.701665
## village3:year2:fcrop6   -3.418046   1.409720  -2.425 0.015408 *
## village4:year2:fcrop6         NA         NA      NA       NA
## village5:year2:fcrop6   -1.733368   0.969497  -1.788 0.073936 .
## village6:year2:fcrop6         NA         NA      NA       NA
## village2:year3:fcrop6    0.704150   1.248835   0.564 0.572920
## village3:year3:fcrop6         NA         NA      NA       NA
## village4:year3:fcrop6         NA         NA      NA       NA
## village5:year3:fcrop6         NA         NA      NA       NA
## village6:year3:fcrop6         NA         NA      NA       NA
## village2:year2:fcrop7   -0.768131   1.474027  -0.521 0.602345
## village3:year2:fcrop7         NA         NA      NA       NA
## village4:year2:fcrop7         NA         NA      NA       NA
## village5:year2:fcrop7         NA         NA      NA       NA
## village6:year2:fcrop7         NA         NA      NA       NA
## village2:year3:fcrop7   -0.726819   1.663714  -0.437 0.662254
## village3:year3:fcrop7         NA         NA      NA       NA
## village4:year3:fcrop7         NA         NA      NA       NA
## village5:year3:fcrop7         NA         NA      NA       NA
## village6:year3:fcrop7         NA         NA      NA       NA
## village2:year2:fcrop8   -0.610708   1.085181  -0.563 0.573651
## village3:year2:fcrop8    0.570307   0.851461   0.670 0.503061
## village4:year2:fcrop8   -1.055004   0.736868  -1.432 0.152368
## village5:year2:fcrop8    1.647409   0.899945   1.831 0.067307 .
## village6:year2:fcrop8         NA         NA      NA       NA
## village2:year3:fcrop8         NA         NA      NA       NA
## village3:year3:fcrop8         NA         NA      NA       NA
## village4:year3:fcrop8   -1.401606   0.741038  -1.891 0.058708 .
## village5:year3:fcrop8         NA         NA      NA       NA
## village6:year3:fcrop8         NA         NA      NA       NA
## village2:year2:fcrop9         NA         NA      NA       NA
## village3:year2:fcrop9         NA         NA      NA       NA
## village4:year2:fcrop9         NA         NA      NA       NA
## village5:year2:fcrop9    1.439062   1.510524   0.953 0.340857
## village6:year2:fcrop9         NA         NA      NA       NA
## village2:year3:fcrop9         NA         NA      NA       NA
## village3:year3:fcrop9         NA         NA      NA       NA
## village4:year3:fcrop9         NA         NA      NA       NA
## village5:year3:fcrop9         NA         NA      NA       NA
## village6:year3:fcrop9         NA         NA      NA       NA
## village2:year2:fcrop11        NA         NA      NA       NA
## village3:year2:fcrop11        NA         NA      NA       NA
## village4:year2:fcrop11        NA         NA      NA       NA
## village5:year2:fcrop11        NA         NA      NA       NA
## village6:year2:fcrop11        NA         NA      NA       NA
## village2:year3:fcrop11        NA         NA      NA       NA
## village3:year3:fcrop11        NA         NA      NA       NA
## village4:year3:fcrop11        NA         NA      NA       NA
## village5:year3:fcrop11        NA         NA      NA       NA
## village6:year3:fcrop11        NA         NA      NA       NA
## village2:year2:fcrop12        NA         NA      NA       NA
## village3:year2:fcrop12        NA         NA      NA       NA
## village4:year2:fcrop12        NA         NA      NA       NA
## village5:year2:fcrop12   3.127968   1.483188   2.109 0.035067 *
```

```
## village6:year2:fcrop12         NA         NA      NA        NA
## village2:year3:fcrop12   -2.744067   1.632575   -1.681  0.092947 .
## village3:year3:fcrop12         NA         NA      NA        NA
## village4:year3:fcrop12         NA         NA      NA        NA
## village5:year3:fcrop12         NA         NA      NA        NA
## village6:year3:fcrop12         NA         NA      NA        NA
## village2:year2:fcrop15         NA         NA      NA        NA
## village3:year2:fcrop15   -3.652010   1.800545   -2.028  0.042658 *
## village4:year2:fcrop15   -0.247572   1.714774   -0.144  0.885218
## village5:year2:fcrop15    0.652379   2.332054    0.280  0.779701
## village6:year2:fcrop15         NA         NA      NA        NA
## village2:year3:fcrop15         NA         NA      NA        NA
## village3:year3:fcrop15         NA         NA      NA        NA
## village4:year3:fcrop15         NA         NA      NA        NA
## village5:year3:fcrop15         NA         NA      NA        NA
## village6:year3:fcrop15         NA         NA      NA        NA
## village2:year2:fcrop16         NA         NA      NA        NA
## village3:year2:fcrop16         NA         NA      NA        NA
## village4:year2:fcrop16         NA         NA      NA        NA
## village5:year2:fcrop16         NA         NA      NA        NA
## village6:year2:fcrop16         NA         NA      NA        NA
## village2:year3:fcrop16         NA         NA      NA        NA
## village3:year3:fcrop16         NA         NA      NA        NA
## village4:year3:fcrop16         NA         NA      NA        NA
## village5:year3:fcrop16         NA         NA      NA        NA
## village6:year3:fcrop16         NA         NA      NA        NA
## village2:year2:fcrop18         NA         NA      NA        NA
## village3:year2:fcrop18         NA         NA      NA        NA
## village4:year2:fcrop18         NA         NA      NA        NA
## village5:year2:fcrop18         NA         NA      NA        NA
## village6:year2:fcrop18         NA         NA      NA        NA
## village2:year3:fcrop18         NA         NA      NA        NA
## village3:year3:fcrop18         NA         NA      NA        NA
## village4:year3:fcrop18         NA         NA      NA        NA
## village5:year3:fcrop18         NA         NA      NA        NA
## village6:year3:fcrop18         NA         NA      NA        NA
## village2:year2:fcrop20         NA         NA      NA        NA
## village3:year2:fcrop20         NA         NA      NA        NA
## village4:year2:fcrop20         NA         NA      NA        NA
## village5:year2:fcrop20         NA         NA      NA        NA
## village6:year2:fcrop20         NA         NA      NA        NA
## village2:year3:fcrop20         NA         NA      NA        NA
## village3:year3:fcrop20         NA         NA      NA        NA
## village4:year3:fcrop20         NA         NA      NA        NA
## village5:year3:fcrop20         NA         NA      NA        NA
## village6:year3:fcrop20         NA         NA      NA        NA
## village2:year2:fcrop22   -2.130195   1.856134   -1.148  0.251244
## village3:year2:fcrop22         NA         NA      NA        NA
## village4:year2:fcrop22         NA         NA      NA        NA
## village5:year2:fcrop22   -0.322185   2.055319   -0.157  0.875452
## village6:year2:fcrop22         NA         NA      NA        NA
## village2:year3:fcrop22         NA         NA      NA        NA
## village3:year3:fcrop22         NA         NA      NA        NA
## village4:year3:fcrop22         NA         NA      NA        NA
```

```
## village5:year3:fcrop22       NA        NA       NA       NA
## village6:year3:fcrop22       NA        NA       NA       NA
## village2:year2:fcrop24       NA        NA       NA       NA
## village3:year2:fcrop24       NA        NA       NA       NA
## village4:year2:fcrop24       NA        NA       NA       NA
## village5:year2:fcrop24       NA        NA       NA       NA
## village6:year2:fcrop24       NA        NA       NA       NA
## village2:year3:fcrop24       NA        NA       NA       NA
## village3:year3:fcrop24       NA        NA       NA       NA
## village4:year3:fcrop24       NA        NA       NA       NA
## village5:year3:fcrop24       NA        NA       NA       NA
## village6:year3:fcrop24       NA        NA       NA       NA
## village2:year2:fcrop25       NA        NA       NA       NA
## village3:year2:fcrop25       NA        NA       NA       NA
## village4:year2:fcrop25       NA        NA       NA       NA
## village5:year2:fcrop25       NA        NA       NA       NA
## village6:year2:fcrop25       NA        NA       NA       NA
## village2:year3:fcrop25       NA        NA       NA       NA
## village3:year3:fcrop25       NA        NA       NA       NA
## village4:year3:fcrop25       NA        NA       NA       NA
## village5:year3:fcrop25       NA        NA       NA       NA
## village6:year3:fcrop25       NA        NA       NA       NA
## village2:year2:fcrop31       NA        NA       NA       NA
## village3:year2:fcrop31  1.213658  1.645176    0.738 0.460775
## village4:year2:fcrop31       NA        NA       NA       NA
## village5:year2:fcrop31  0.602292  0.570358    1.056 0.291095
## village6:year2:fcrop31       NA        NA       NA       NA
## village2:year3:fcrop31       NA        NA       NA       NA
## village3:year3:fcrop31       NA        NA       NA       NA
## village4:year3:fcrop31       NA        NA       NA       NA
## village5:year3:fcrop31       NA        NA       NA       NA
## village6:year3:fcrop31       NA        NA       NA       NA
## village2:year2:fcrop32       NA        NA       NA       NA
## village3:year2:fcrop32       NA        NA       NA       NA
## village4:year2:fcrop32       NA        NA       NA       NA
## village5:year2:fcrop32       NA        NA       NA       NA
## village6:year2:fcrop32       NA        NA       NA       NA
## village2:year3:fcrop32       NA        NA       NA       NA
## village3:year3:fcrop32       NA        NA       NA       NA
## village4:year3:fcrop32       NA        NA       NA       NA
## village5:year3:fcrop32       NA        NA       NA       NA
## village6:year3:fcrop32       NA        NA       NA       NA
## village2:year2:fcrop44       NA        NA       NA       NA
## village3:year2:fcrop44       NA        NA       NA       NA
## village4:year2:fcrop44       NA        NA       NA       NA
## village5:year2:fcrop44 -1.606997  1.284514   -1.251 0.211054
## village6:year2:fcrop44       NA        NA       NA       NA
## village2:year3:fcrop44       NA        NA       NA       NA
## village3:year3:fcrop44       NA        NA       NA       NA
## village4:year3:fcrop44       NA        NA       NA       NA
## village5:year3:fcrop44       NA        NA       NA       NA
## village6:year3:fcrop44       NA        NA       NA       NA
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
## 
## Residual standard error: 1.098 on 2093 degrees of freedom
##   (306 observations deleted due to missingness)
## Multiple R-squared:  0.6702, Adjusted R-squared:  0.6424
## F-statistic: 24.16 on 176 and 2093 DF,  p-value: < 2.2e-16
```