Assets model

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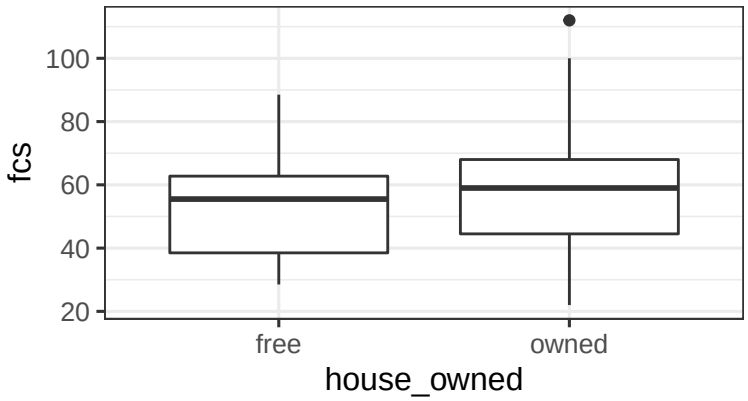
Data Prep

```
# reading in the data
bihs <- read.csv('bihs_final.csv')
bihs_original <- read_excel('../tidy_dataset/BIHS_household_2011_15.xlsx')
```

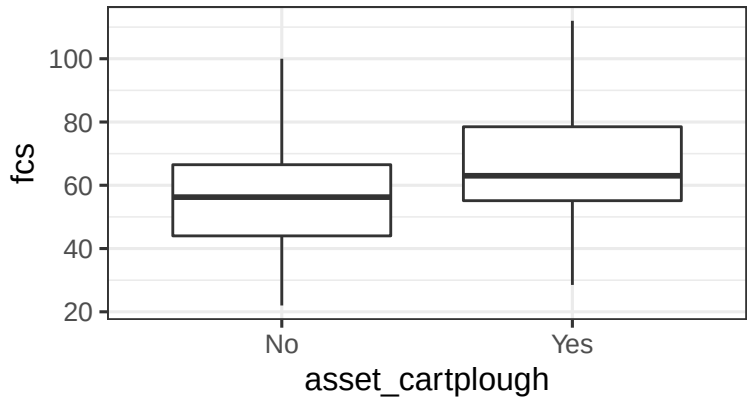
```
# adding house_owned variable to bihs dataset
bihs <- bihs %>% mutate(house_owned = bihs_original$house_owned) %>%
  select(
          fcs,
          year,
          house_owned,
          asset_radio,
          asset_telephone,
          asset_tractor,
          asset_television,
          asset_motorbike,
          asset_cartplough,
          asset_qty_poultry,
          asset_qty_cattle,
          asset_qty_otherlivestock,
          asset_qty_sheepgoat
        ) %>%
  na.omit()
```

Exploratory plots

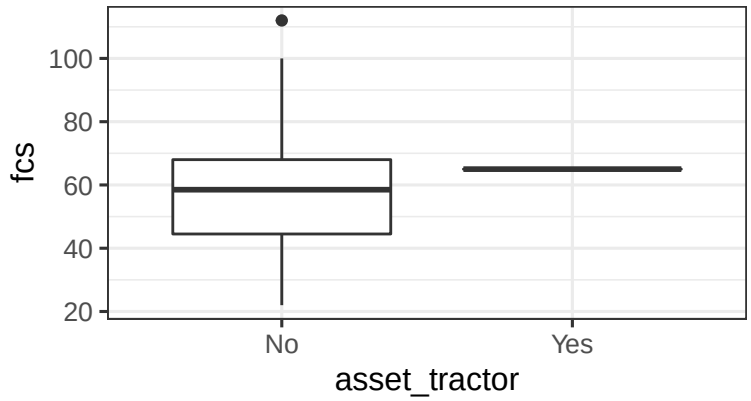
```
# whether they owned/rented a house
gf_boxplot(data = bihs, fcs ~ house_owned)
```



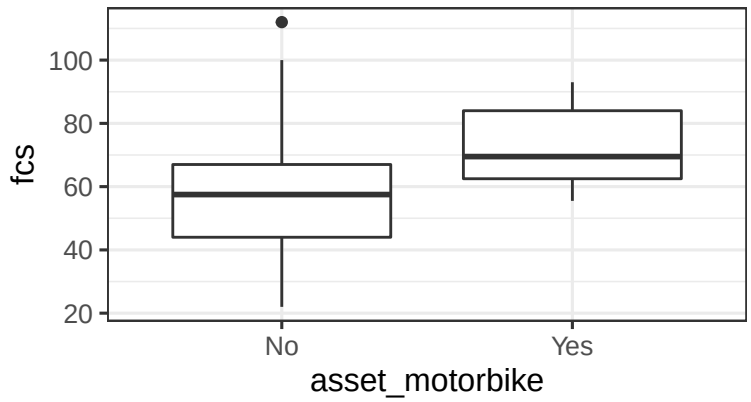

```
# tech assets
gf_boxplot(data = bihs, fcs ~ asset_cartplough)
```



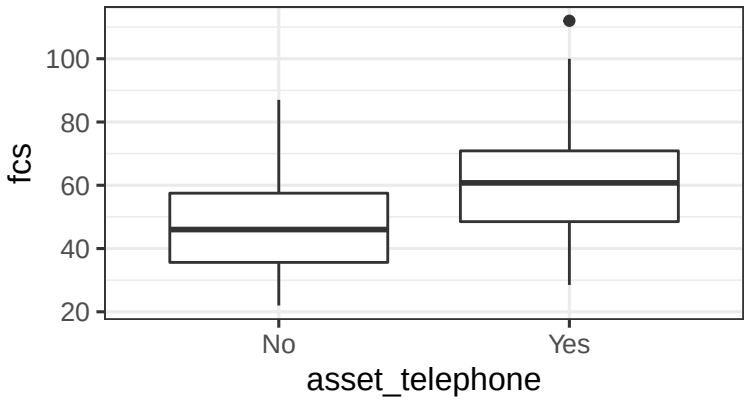

```
gf_boxplot(data = bihs, fcs ~ asset_tractor)
```



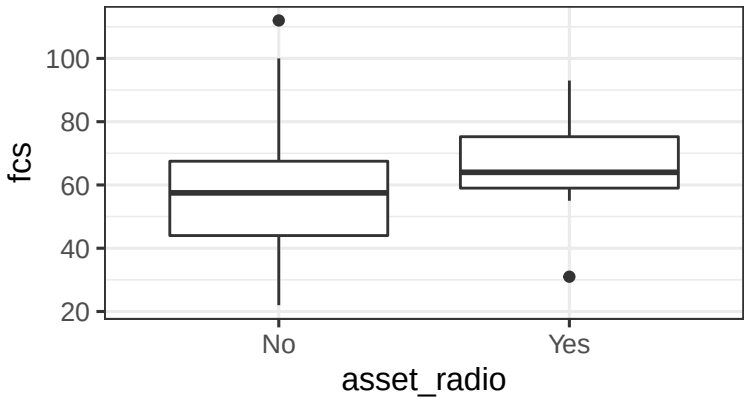

```
gf_boxplot(data = bihs, fcs ~ asset_motorbike)
```




```
gf_boxplot(data = bihs, fcs ~ asset_telephone)
```




```
gf_boxplot(data = bihs, fcs ~ asset_radio)
```



Fitting the model

try changing categorical to 1 and 0

```
head(bihs)
```

```
##    fcs year house_owned asset_radio asset_telephone asset_tractor
## 1 59.0 2011       owned          No             Yes            No
## 2 24.5 2011       owned          No              No            No
## 3 79.5 2011       owned          No             Yes            No
## 4 59.5 2011       owned         Yes             Yes            No
## 5 40.5 2011       owned          No             Yes            No
## 6 87.5 2011       owned          No             Yes            No
##   asset_television asset_motorbike asset_cartplough asset_qty_poultry
## 1              Yes             Yes               No                 0
## 2              Yes              No               No                 0
## 3               No              No               No                 0
## 4               No              No               No                 0
## 5               No              No               No                 0
## 6               No              No               No                 0
##   asset_qty_cattle asset_qty_otherlivestock asset_qty_sheepgoat
## 1                0                        0                  0
## 2                0                        0                  0
## 3                0                        0                  0
## 4                0                        0                  0
## 5                0                        0                  0
```

```
## 6                0                          0                    0
```

```
asset_lm <- lm(data = bihs, fcs ~ house_owned + asset_cartplough + asset_tractor + asset_motorbike + ass
summary(asset_lm)
```

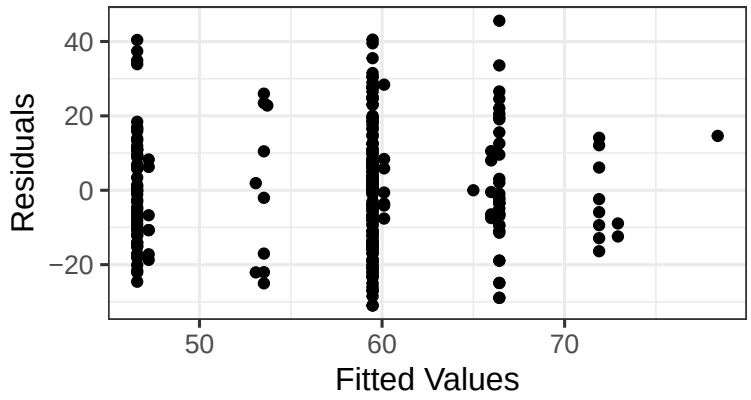
```
##
## Call:
## lm(formula = fcs ~ house_owned + asset_cartplough + asset_tractor +
##     asset_motorbike + asset_telephone + asset_radio, data = bihs,
##     na.action = "na.fail")
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -30.982 -11.982  -0.767  10.484  45.577
##
## Coefficients:
##                      Estimate Std. Error t value Pr(>|t|)
## (Intercept)           47.2158     4.3543  10.843  < 2e-16 ***
## house_ownedowned      -0.6293     4.4048  -0.143   0.8865
## asset_cartploughYes    6.9415     2.7819   2.495   0.0132 *
## asset_tractorYes       5.5183    16.3227   0.338   0.7356
## asset_motorbikeYes    12.4075     5.5977   2.217   0.0275 *
## asset_telephoneYes    12.8951     2.3477   5.493 9.64e-08 ***
## asset_radioYes         6.4970     5.0267   1.292   0.1974
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 16.27 on 253 degrees of freedom
## Multiple R-squared:  0.1637, Adjusted R-squared:  0.1439
## F-statistic: 8.254 on 6 and 253 DF,  p-value: 3.588e-08
```

```
# collinearity check
vif(asset_lm)
```

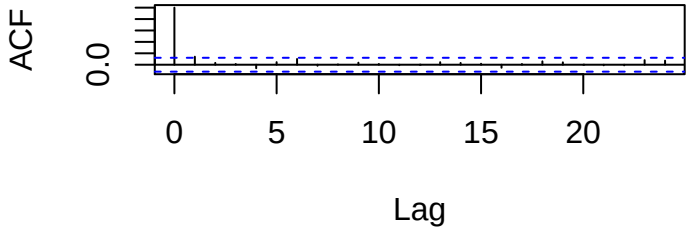
```
##      house_owned asset_cartplough    asset_tractor  asset_motorbike
##         1.036406         1.029941         1.002997         1.028848
##  asset_telephone      asset_radio
##         1.045979         1.005963
```

Model assessment

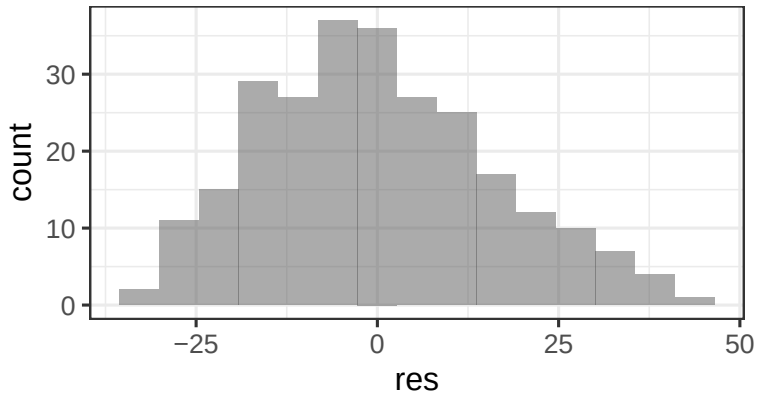
```
# linearity and constant variance - predictors are categorical tho...?
bihs <- bihs %>%
  mutate(res = resid(asset_lm),
         fitted = predict(asset_lm))
gf_point(res ~ fitted, data = bihs) %>%
  gf_labs(x = 'Fitted Values', y = 'Residuals')
```




```
# independence
acf(resid(asset_lm), main = '')
```




```
#normality of residuals
gf_histogram(~res, data = bihs, bins = 15) # they look a bit right skewed...
```



Model Assessment

```
AIC_results <- dredge(asset_lm, rank = 'AIC')
head(AIC_results, 7)
```

```
## Global model call: lm(formula = fcs ~ house_owned + asset_cartplough + asset_tractor +
##     asset_motorbike + asset_telephone + asset_radio, data = bihs,
##     na.action = "na.fail")
## ---
## Model selection table
##    (Int) ass_crt ass_mtr ass_rad ass_tlp ass_trc hos_own df    logLik
## 12 46.95       +       +               +                 5 -1091.476
## 16 46.67       +       +       +       +                 6 -1090.619
## 28 46.94       +       +               +       +         6 -1091.424
```

```
## 44 47.65       +       +               +               +  6 -1091.459
## 32 46.66       +       +       +       +       +          7 -1090.561
## 48 47.20       +       +       +       +               +  7 -1090.609
## 14 46.69       +               +       +                  5 -1093.096
##       AIC delta weight
## 12 2193.0  0.00  0.287
## 16 2193.2  0.29  0.249
## 28 2194.8  1.89  0.111
## 44 2194.9  1.97  0.107
## 32 2195.1  2.17  0.097
## 48 2195.2  2.27  0.092
## 14 2196.2  3.24  0.057
## Models ranked by AIC(x)
```

```
BIC_results <- dredge(asset_lm, rank = 'BIC')
head(BIC_results, 7)
```

```
## Global model call: lm(formula = fcs ~ house_owned + asset_cartplough + asset_tractor +
##     asset_motorbike + asset_telephone + asset_radio, data = bihs,
##     na.action = "na.fail")
## ---
## Model selection table
##    (Int) ass_crt ass_mtr ass_rad ass_tlp df    logLik    BIC delta weight
## 9  47.66                             +  3 -1096.764 2210.2  0.00  0.280
## 10 47.01       +                     +  4 -1094.145 2210.5  0.32  0.238
## 12 46.95       +       +             +  5 -1091.476 2210.8  0.55  0.213
## 11 47.66               +             +  4 -1094.647 2211.5  1.33  0.144
## 13 47.34                       +       +  4 -1095.696 2213.6  3.42  0.051
## 14 46.69       +               +       +  5 -1093.096 2214.0  3.79  0.042
## 16 46.67       +       +       +       +  6 -1090.619 2214.6  4.39  0.031
## Models ranked by BIC(x)
```

```
# best bic model...?
asset_lm_bic <- lm(data = bihs, fcs ~ asset_telephone, na.action = 'na.fail')
summary(asset_lm_bic)
```

```
##
## Call:
## lm(formula = fcs ~ asset_telephone, data = bihs, na.action = "na.fail")
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -33.151 -13.151  -1.151   9.838  50.349
##
## Coefficients:
##                    Estimate Std. Error t value Pr(>|t|)
## (Intercept)          47.662      2.001  23.823  < 2e-16 ***
## asset_telephoneYes   13.989      2.328   6.009 6.34e-09 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 16.5 on 258 degrees of freedom
## Multiple R-squared:  0.1228, Adjusted R-squared:  0.1194
## F-statistic:  36.1 on 1 and 258 DF,  p-value: 6.342e-09
```

```r
asset_lm_all <- lm(data = bihs_original, fcs ~ factor(survey_year) + asset_qty_poultry + asset_qty_cattl
summary(asset_lm_all)
```

```
##
## Call:
## lm(formula = fcs ~ factor(survey_year) + asset_qty_poultry +
##     asset_qty_cattle + asset_qty_otherlivestock + asset_qty_sheepgoat +
##     memb_total + memb_und15 + memb_15_44 + hhs_total + bio_bio_1 +
##     bio_bio_12, data = bihs_original)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -37.119 -12.054  -0.865  10.595  51.877
##
## Coefficients:
##                             Estimate Std. Error t value Pr(>|t|)
## (Intercept)              -27.596536 270.655923  -0.102 0.918827
## factor(survey_year)2015    8.403096   1.748418   4.806 2.02e-06 ***
## asset_qty_poultry          0.098423   0.136666   0.720 0.471744
## asset_qty_cattle           2.423539   0.698881   3.468 0.000569 ***
## asset_qty_otherlivestock  -0.162446   0.315243  -0.515 0.606561
## asset_qty_sheepgoat       -0.014030   1.046830  -0.013 0.989312
## memb_total                 0.976431   0.658199   1.483 0.138553
## memb_und15                -0.045341   0.802431  -0.057 0.954962
## memb_15_44                 1.150961   0.849113   1.355 0.175853
## hhs_total                  7.646841   1.358407   5.629 2.97e-08 ***
## bio_bio_1                  2.180512  10.094620   0.216 0.829067
## bio_bio_12                -0.008513   0.006454  -1.319 0.187751
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 16.24 on 518 degrees of freedom
##   (14 observations deleted due to missingness)
## Multiple R-squared:  0.2848, Adjusted R-squared:  0.2696
## F-statistic: 18.76 on 11 and 518 DF,  p-value: < 2.2e-16
```

```r
vif(asset_lm_all)
```

```
##      factor(survey_year)        asset_qty_poultry         asset_qty_cattle
##                 1.534704                 1.387393                 1.469670
## asset_qty_otherlivestock      asset_qty_sheepgoat               memb_total
##                 1.041566                 1.099741                 3.321780
##               memb_und15              memb_15_44               hhs_total
##                 1.885714                 2.026934                 1.175876
##                bio_bio_1              bio_bio_12
##                 9.987758                 9.892606
```

```r
asset_lm_all_two <- lm(data = bihs_original, fcs ~ factor(survey_year) + asset_qty_poultry + asset_qty_

summary(asset_lm_all_two)
```

```
##
## Call:
## lm(formula = fcs ~ factor(survey_year) + asset_qty_poultry +
##     asset_qty_cattle + asset_qty_otherlivestock + asset_qty_sheepgoat +
```

```
##     memb_total + memb_und15 + memb_15_44 + hhs_total + bio_bio_1 +
##     bio_bio_12 + factor(house_owned) + factor(asset_cartplough) +
##     factor(asset_telephone), data = bihs_original)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -31.560 -10.627  -0.697   9.491  44.950
##
## Coefficients:
##                               Estimate Std. Error t value Pr(>|t|)
## (Intercept)                 132.268232 353.041500   0.375 0.708197
## factor(survey_year)2015       2.824916   4.567763   0.618 0.536775
## asset_qty_poultry             0.002366   0.240925   0.010 0.992170
## asset_qty_cattle              2.758238   1.300787   2.120 0.034833 *
## asset_qty_otherlivestock     -0.365057   0.339079  -1.077 0.282563
## asset_qty_sheepgoat          -1.411200   2.072145  -0.681 0.496403
## memb_total                    2.758834   1.104307   2.498 0.013044 *
## memb_und15                   -1.840420   1.175480  -1.566 0.118534
## memb_15_44                   -1.158268   1.261428  -0.918 0.359281
## hhs_total                     4.812035   1.552080   3.100 0.002126 **
## bio_bio_1                    -3.415063  13.176284  -0.259 0.795681
## bio_bio_12                   -0.010803   0.008462  -1.277 0.202776
## factor(house_owned)owned     -4.103573   4.314379  -0.951 0.342340
## factor(asset_cartplough)Yes   4.990623   2.556769   1.952 0.051926 .
## factor(asset_telephone)Yes    8.504240   2.513287   3.384 0.000815 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 15.56 on 285 degrees of freedom
##   (244 observations deleted due to missingness)
## Multiple R-squared:  0.2986, Adjusted R-squared:  0.2641
## F-statistic: 8.665 on 14 and 285 DF,  p-value: 1.192e-15
```

```
vif(asset_lm_all_two)
```

```
##      factor(survey_year)        asset_qty_poultry         asset_qty_cattle
##                 3.175399                 1.785341                 2.411222
## asset_qty_otherlivestock      asset_qty_sheepgoat               memb_total
##                 1.094819                 1.175269                 5.405350
##               memb_und15               memb_15_44                hhs_total
##                 2.550880                 2.752706                 1.334021
##                bio_bio_1               bio_bio_12      factor(house_owned)
##                10.335599                10.288256                 1.095878
## factor(asset_cartplough)  factor(asset_telephone)
##                 1.312503                 1.372369
```