

Estimated Weighted Least Squares with R

```
> help(chickwts)
starting httpd help server ... done
> attach(chickwts)
> head(chickwts)
  weight      feed
1    179 horsebean
2    160 horsebean
3    136 horsebean
4    227 horsebean
5    217 horsebean
6    168 horsebean
>
> aggregate(weight,by=list(feed),FUN=mean)
  Group.1      x
1   casein 323.5833
2 horsebean 160.2000
3   linseed 218.7500
4  meatmeal 276.9091
5   soybean 246.4286
6 sunflower 328.9167
> aggregate(weight,by=list(feed),FUN=var)
  Group.1      x
1   casein 4151.720
2 horsebean 1491.956
3   linseed 2728.568
4  meatmeal 4212.091
5   soybean 2929.956
6 sunflower 2384.992
>
> summary(lm(weight ~ feed))

Call:
lm(formula = weight ~ feed)

Residuals:
    Min       1Q   Median       3Q      Max
-123.909  -34.413    1.571   38.170  103.091

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)   323.583    15.834   20.436 < 2e-16 ***
feedhorsebean -163.383    23.485  -6.957 2.07e-09 ***
feedlinseed   -104.833    22.393  -4.682 1.49e-05 ***
feedmeatmeal  -46.674    22.896  -2.039 0.045567 *
feedsoybean   -77.155    21.578  -3.576 0.000665 ***
feedsunflower   5.333    22.393   0.238 0.812495
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 54.85 on 65 degrees of freedom
Multiple R-squared:  0.5417, Adjusted R-squared:  0.5064
F-statistic: 15.36 on 5 and 65 DF, p-value: 5.936e-10
```

```

>
> # Test diff between casin and meatmeal with estimated gls
> source("http://www.utstat.utoronto.ca/~brunner/Rfunctions/ftest.txt")
> # Weight observations by inverse of estimated variance
> groupvar = aggregate(weight,by=list(feed),FUN=var)[,2] # Column 2
> charfeed = as.character(feed) # Character (not factor) version of feed
> feedname = sort(unique(charfeed)); feedname
[1] "casein"      "horsebean"   "linseed"     "meatmeal"    "soybean"     "sunflower"
> n = length(feed)
> wt = numeric(n) # All zeros -- weights will go here
> for(j in 1:6) wt[charfeed==feedname[j]] = 1/groupvar[j] # Reciprocal of var
> head(data.frame(weight,feed,wt))
  weight      feed      wt
1    179 horsebean 0.0006702613
2    160 horsebean 0.0006702613
3    136 horsebean 0.0006702613
4    227 horsebean 0.0006702613
5    217 horsebean 0.0006702613
6    168 horsebean 0.0006702613
>
>
> ols = lm(weight ~ 0 + feed); summary(ols)

```

Call:

```
lm(formula = weight ~ 0 + feed)
```

Residuals:

Min	1Q	Median	3Q	Max
-123.909	-34.413	1.571	38.170	103.091

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
feedcasein	323.58	15.83	20.436	< 2e-16 ***
feedhorsebean	160.20	17.35	9.236	1.91e-13 ***
feedlinseed	218.75	15.83	13.815	< 2e-16 ***
feedmeatmeal	276.91	16.54	16.744	< 2e-16 ***
feedsoybean	246.43	14.66	16.810	< 2e-16 ***
feedsunflower	328.92	15.83	20.773	< 2e-16 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 54.85 on 65 degrees of freedom
Multiple R-squared: 0.9629, Adjusted R-squared: 0.9595
F-statistic: 281.4 on 6 and 65 DF, p-value: < 2.2e-16

```

> C1 = rbind(c(1,0,0,-1,0,0))
> fttest(ols,C1) # Compare p = 0.045567
      F      df1      df2      p-value
4.15568686 1.00000000 65.00000000 0.04556672

```

```

>
> gls = lm(weight ~ 0 + feed, weights=wt)
> fttest(gls,C1)
      F      df1      df2      p-value
2.98875408 1.00000000 65.00000000 0.08859212

```