

Heteroskedasticity

. reg

```

Source |   SS    df   MS   Number of obs =   2,380
-----+----- F(2, 2377)   =   72.38
Model | 14.4018246    2 7.20091231 Prob > F    = 0.0000
Residual | 236.470024  2,377 .099482551 R-squared   = 0.0574
-----+----- Adj R-squared = 0.0566
Total | 250.871849  2,379 .105452648 Root MSE    = .31541

```

```

-----
deny |   Coef. Std. Err.   t  P>|t|   [95% Conf. Interval]
-----+-----
black | .1852838 .0185183  10.01 0.000   .1489701 .2215975
diratio | .0041624 .0006697   6.21 0.000   .002849 .0054757
_cons | -.0129275 .0183595  -0.70 0.481  -.0489297 .0230747
-----

```

. reg wage black exper educ married tenure

```

Source |   SS    df   MS   Number of obs =   935
-----+----- F(5, 929)   =   41.49
Model | 27877394.4    5 5575478.87 Prob > F    = 0.0000
Residual | 124838774    929 134379.735 R-squared   = 0.1825
-----+----- Adj R-squared = 0.1781
Total | 152716168    934 163507.675 Root MSE    = 366.58

```

```

-----
wage |   Coef. Std. Err.   t  P>|t|   [95% Conf. Interval]
-----+-----
black | -165.779 36.63538  -4.53 0.000  -237.6767 -93.88128
exper |  13.74964 3.194597   4.30 0.000   7.480175 20.0191
educ |  70.12317 6.246289  11.23 0.000  57.86469 82.38164
married | 169.3729 39.13087   4.33 0.000  92.57774 246.168
tenure |  6.825021 2.456656   2.78 0.006   2.003781 11.64626
_cons | -324.8561 111.7212  -2.91 0.004  -544.1113 -105.6009
-----

```

. imtest

Cameron & Trivedi's decomposition of IM-test

```

-----
Source |   chi2   df   p
-----+-----
Heteroskedasticity |  31.80  18 0.0232
Skewness |  20.10   5 0.0012
Kurtosis |   6.28   1 0.0122

```

```
-----+-----
Total | 58.18 24 0.0001
-----
```

```
. predict yhat
(option xb assumed; fitted values)
```

```
. predict uhat, res
```

```
. gen uhat2=uhat^2
```

```
. twoway (scatter yhat uhat2)(lfit yhat uhat2)
```

```
. twoway (scatter yhat uhat2)(lfit yhat uhat2)
```

```
. twoway (scatter uhat2 yhat)(lfit uhat2 yhat)
```

```
. reg wage educ exper black
```

```
Source |   SS      df   MS   Number of obs =   935
-----+----- F(3, 931)   =  58.35
Model | 24170667    3 8056888.99 Prob > F   =  0.0000
Residual | 128545501  931 138072.504 R-squared   =  0.1583
-----+----- Adj R-squared =  0.1556
Total | 152716168  934 163507.675 Root MSE   =  371.58
```

```
-----+-----
wage |   Coef. Std. Err.   t  P>|t|   [95% Conf. Interval]
-----+-----
educ | 70.76892  6.313233  11.21  0.000   58.37911  83.15874
exper | 17.17764  3.123536   5.50  0.000   11.04765  23.30763
black | -183.9836 36.94778  -4.98  0.000  -256.4942 -111.473
_cons | -170.2253 107.8931  -1.58  0.115  -381.9672  41.5166
-----
```

```
. reg wage black
```

```
Source |   SS      df   MS   Number of obs =   935
-----+----- F(1, 933)   =  43.42
Model | 6791210.29    1 6791210.29 Prob > F   =  0.0000
Residual | 145924958  933 156404.028 R-squared   =  0.0445
-----+----- Adj R-squared =  0.0434
Total | 152716168  934 163507.675 Root MSE   =  395.48
```

```
-----+-----
wage |   Coef. Std. Err.   t  P>|t|   [95% Conf. Interval]
-----+-----
black | -254.8062 38.66877  -6.59  0.000  -330.694 -178.9183
_cons | 990.6479 13.85304  71.51  0.000   963.4611 1017.835
```

```
-----  
. su wage if black==0
```

Variable	Obs	Mean	Std. Dev.	Min	Max
wage	815	990.6479	408.0027	115	3078

```
. gen errvar = 1 + educ/10
```

```
. gen sqerv = (errvar)^(1/2)
```

```
. gen wageX = wage/sqerv
```

```
. gen educX = educ/sqerv
```

```
. gen experX = exper/sqerv
```

```
. gen blackX = black/sqerv
```

```
. gen marriedX = married/sqerv
```

```
. reg wageX educX experX marriedX blackX
```

Source	SS	df	MS	Number of obs =	935
				F(4, 930) =	32.23
Model	7300812.72	4	1825203.18	Prob > F =	0.0000
Residual	52658690.7	930	56622.2481	R-squared =	0.1218
				Adj R-squared =	0.1180
Total	59959503.5	934	64196.4705	Root MSE =	237.95

wageX	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
educX	80.67096	9.399437	8.58	0.000	62.22439	99.11752
experX	15.45425	3.03552	5.09	0.000	9.496983	21.41151
marriedX	169.7393	38.9898	4.35	0.000	93.22111	246.2575
blackX	-169.0651	35.49787	-4.76	0.000	-238.7303	-99.39986
_cons	-285.6664	101.6756	-2.81	0.005	-485.2066	-86.12615

```
-----  
. imtest
```

Cameron & Trivedi's decomposition of IM-test

Source	chi2	df	p
Heteroskedasticity	12.81	14	0.5412

```

Skewness | 15.52  4  0.0037
Kurtosis |  5.41  1  0.0201
-----+-----
Total |  33.74  19  0.0197
-----+-----

```

. reg wage educ exper married black

```

Source |   SS      df   MS   Number of obs =   935
-----+----- F(4, 930)   =  49.58
Model | 26840217.4    4 6710054.34 Prob > F   =  0.0000
Residual | 125875951   930 135350.485 R-squared   =  0.1758
-----+----- Adj R-squared =  0.1722
Total | 152716168   934 163507.675 Root MSE   =  367.9
-----+-----

```

```

wage |   Coef. Std. Err.   t  P>|t|   [95% Conf. Interval]
-----+-----
educ |  71.38448  6.252229  11.42  0.000   59.11437   83.65459
exper |  15.96504  3.104623   5.14  0.000   9.872156  22.05791
married | 174.2356  39.23265   4.44  0.000   97.24077  251.2303
black | -173.7683  36.65401  -4.74  0.000  -245.7025 -101.8342
_cons | -321.4056 112.1171  -2.87  0.004  -541.4374 -101.3738
-----+-----

```

. imtest

Cameron & Trivedi's decomposition of IM-test

```

Source |   chi2  df  p
-----+-----
Heteroskedasticity |  19.80  12  0.0710
Skewness |  16.40   4  0.0025
Kurtosis |   5.83   1  0.0157
-----+-----
Total |  42.03  17  0.0007
-----+-----

```

. reg wage educ exper married black [aweight = 1/sqrv]
sqrv not found
r(111);

. reg wage educ exper married black [aweight = 1/sqerv]
(sum of wgt is 6.1228e+02)

```

Source |   SS      df   MS   Number of obs =   935
-----+----- F(4, 930)   =  49.18
Model | 26270353.2    4 6567588.3 Prob > F   =  0.0000

```

```

Residual | 124190993   930 133538.702 R-squared   = 0.1746
-----+-----
Adj R-squared = 0.1710
Total | 150461346   934 161093.518 Root MSE   = 365.43

```

```

-----
wage |   Coef. Std. Err.   t  P>|t|   [95% Conf. Interval]
-----+-----
educ | 71.44732 6.279886  11.38 0.000   59.12293  83.77171
exper | 15.72044 3.071453   5.12 0.000   9.692661 21.74823
married | 172.0082 39.11049   4.40 0.000  95.25319 248.7633
black | -171.331 36.06661  -4.75 0.000 -242.1123 -100.5496
_cons | -317.7589 111.7428  -2.84 0.005 -537.0561 -98.4617
-----

```

```
. su errvar
```

```

Variable |   Obs   Mean  Std. Dev.   Min    Max
-----+-----
errvar |   935  2.346845  .2196654    1.9    2.8

```

```
. reg wage educ exper married black [aweight = 1/errvar]
(sum of wgt is 4.0178e+02)
```

```

Source |   SS      df   MS   Number of obs =   935
-----+-----
F(4, 930) = 48.73
Model | 25682162.3    4 6420540.56 Prob > F   = 0.0000
Residual | 122535396   930 131758.491 R-squared   = 0.1733
-----+-----
Adj R-squared = 0.1697
Total | 148217559   934 158691.176 Root MSE   = 362.99

```

```

-----
wage |   Coef. Std. Err.   t  P>|t|   [95% Conf. Interval]
-----+-----
educ | 71.51495 6.313455  11.33 0.000   59.12468  83.90522
exper | 15.49611 3.039568   5.10 0.000   9.530907 21.46132
married | 169.9 38.99018   4.36 0.000  93.38107 246.4189
black | -168.9066 35.5017  -4.76 0.000 -238.5793 -99.23386
_cons | -314.4925 111.4488  -2.82 0.005 -533.2127 -95.77226
-----

```

```
. drop uhat-marriedX
```

```
. reg wage educ exper black married
```

```

Source |   SS      df   MS   Number of obs =   935
-----+-----
F(4, 930) = 49.58
Model | 26840217.4    4 6710054.34 Prob > F   = 0.0000
Residual | 125875951   930 135350.485 R-squared   = 0.1758
-----+-----
Adj R-squared = 0.1722

```

Total | 152716168 934 163507.675 Root MSE = 367.9

wage	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
educ	71.38448	6.252229	11.42	0.000	59.11437	83.65459
exper	15.96504	3.104623	5.14	0.000	9.872156	22.05791
black	-173.7683	36.65401	-4.74	0.000	-245.7025	-101.8342
married	174.2356	39.23265	4.44	0.000	97.24077	251.2303
_cons	-321.4056	112.1171	-2.87	0.004	-541.4374	-101.3738

. predict uhat, res

. gen u2 = uhat^2

. predict yhat
variable yhat already defined
r(110);

. drop yhat

. predict yhat
(option xb assumed; fitted values)

. gen y2 = yhat^2

. gen lu2 = log(u2)

. reg lu2 yhat y2

Source	SS	df	MS	Number of obs =	935
				F(2, 932) =	10.90
Model	120.807366	2	60.4036828	Prob > F =	0.0000
Residual	5163.62442	932	5.54036955	R-squared =	0.0229
				Adj R-squared =	0.0208
Total	5284.43179	934	5.65784988	Root MSE =	2.3538

lu2	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
yhat	.0022399	.0038186	0.59	0.558	-.0052541	.0097339
y2	-6.20e-08	1.98e-06	-0.03	0.975	-3.96e-06	3.83e-06
_cons	8.226201	1.808777	4.55	0.000	4.676454	11.77595

. predict ghat
(option xb assumed; fitted values)

```
. gen hhat = exp(ghat)
```

```
. reg wage married black educ exper [aweights = 1/hhat]  
aweights unknown weight type  
r(198);
```

```
. reg wage married black educ exper [aweights = 1/hhat]  
aweights unknown weight type  
r(198);
```

```
. reg wage married black educ exper [aweight = 1/hhat]  
(sum of wgt is 3.3116e-02)
```

```
Source |   SS      df   MS   Number of obs =   935  
-----+----- F(4, 930)   =   49.05  
Model | 23786881.9    4 5946720.46 Prob > F    = 0.0000  
Residual | 112759481    930 121246.754 R-squared   = 0.1742  
-----+----- Adj R-squared = 0.1707  
Total | 136546363    934 146195.249 Root MSE    = 348.21
```

```
-----  
wage |   Coef. Std. Err.   t P>|t| [95% Conf. Interval]  
-----+-----  
married | 157.3897 32.16168   4.89 0.000   94.27177 220.5075  
black | -165.2465 29.09903  -5.68 0.000  -222.3539 -108.1392  
educ | 67.41209 6.454269  10.44 0.000   54.74547 80.07871  
exper | 13.7148 2.843612   4.82 0.000   8.134161 19.29544  
_cons | -229.6603 106.5244  -2.16 0.031  -438.7164 -20.60421  
-----
```

```
. imtest  
imtest does not support weights  
r(101);
```

```
. imtest, white  
imtest does not support weights  
r(101);
```

```
. predict newres, r
```

```
. predict newfit  
(option xb assumed; fitted values)
```

```
. gen nr2 = newres^2
```

```
. reg nr2 newfit
```

```
Source |   SS      df   MS   Number of obs =   935  
-----+----- F(1, 933)   =   16.25
```

```

Model | 1.5693e+12    1 1.5693e+12 Prob > F    = 0.0001
Residual | 9.0082e+13   933 9.6551e+10 R-squared    = 0.0171
-----+-----
Total | 9.1651e+13   934 9.8128e+10 Root MSE    = 3.1e+05

```

```

-----
nr2 |   Coef. Std. Err.   t  P>|t|   [95% Conf. Interval]
-----+-----
newfit | 256.7271  63.67962   4.03 0.000   131.7552   381.699
_cons | -110714.4  61733.67  -1.79 0.073  -231867.3  10438.52
-----

```

```
. gen wdum = wage > 958
```

```
. tab wdum
```

```

wdum |   Freq.   Percent   Cum.
-----+-----
  0 |    517    55.29    55.29
  1 |    418    44.71   100.00
-----+-----
Total |    935   100.00

```

```
. reg wdum educ married exper black
```

```

Source |   SS      df   MS   Number of obs =   935
-----+----- F(4, 930)   =  28.89
Model | 25.5481907    4 6.38704767 Prob > F    = 0.0000
Residual | 205.581221   930 .221055076 R-squared    = 0.1105
-----+-----
Total | 231.129412   934 .247461897 Root MSE    = .47016

```

```

-----
wdum |   Coef. Std. Err.   t  P>|t|   [95% Conf. Interval]
-----+-----
educ | .067396 .0079902   8.43 0.000   .0517152 .0830769
married | .1750631 .0501381   3.49 0.001   .0766662 .27346
exper | .0196531 .0039676   4.95 0.000   .0118666 .0274396
black | -.1810666 .0468427  -3.87 0.000  -.2729962 -.089137
_cons | -.8210238 .1432822  -5.73 0.000  -1.102218 -.53983
-----

```

```
. rvfplot
```

```
. drop uhat-newfit
```

```
. predict yhat
```

```
(option xb assumed; fitted values)
```



```
. gen hhat = yaht*(1-yhat)
yaht not found
r(111);
```

```
. gen hhat = yhat*(1-yhat)
```

```
. reg wdum educ exper black married [aweight = 1/hhat]
(sum of wgt is 5.2146e+03)
```

```
Source |   SS      df   MS   Number of obs =   930
-----+----- F(4, 925)   =  60.36
Model | 44.7636133    4 11.1909033 Prob > F    =  0.0000
Residual | 171.508115   925 .185414178 R-squared   =  0.2070
-----+----- Adj R-squared =  0.2035
Total | 216.271728   929 .232800568 Root MSE    =  .4306
```

```
-----
wdum |   Coef. Std. Err.   t  P>|t|   [95% Conf. Interval]
-----+-----
educ | .0669386 .0073646   9.09 0.000   .0524853   .081392
exper | .0204115 .0029752   6.86 0.000   .0145725   .0262505
black | -.1598059 .0368261  -4.34 0.000  -.2320783  -.0875335
married | .1234755 .043071   2.87 0.004   .0389474   .2080037
_cons | -.7761806 .1228097  -6.32 0.000  -1.017198  -.5351627
-----
```

```
. reg wage black married exper educ, robust
```

```
Linear regression           Number of obs =   935
                          F(4, 930)   =  50.97
                          Prob > F    =  0.0000
                          R-squared    =  0.1758
                          Root MSE   =  367.9
```

```
-----
|           Robust
wage |   Coef. Std. Err.   t  P>|t|   [95% Conf. Interval]
-----+-----
black | -173.7683  29.8445  -5.82 0.000  -232.3387  -115.198
married | 174.2356  35.78689  4.87 0.000   104.0031  244.468
exper | 15.96504  3.078111  5.19 0.000   9.924187  22.00588
educ | 71.38448  6.676333  10.69 0.000   58.28206  84.4869
_cons | -321.4056  114.6477  -2.80 0.005  -546.4038  -96.40733
-----
```