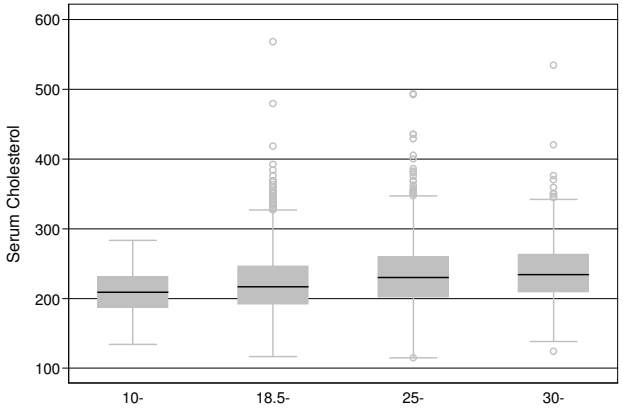
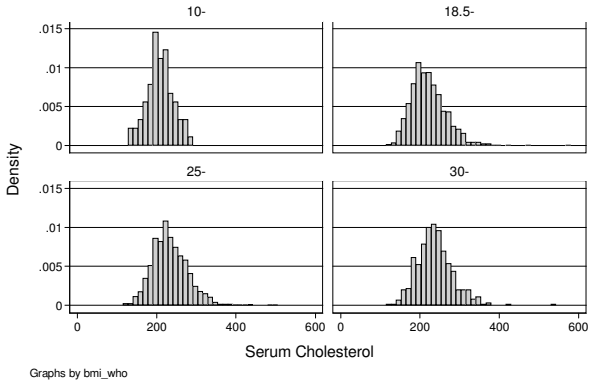
Q1

```
graph box scl, over(bmi_who)
```



Q1

```
hist scl, by(bmi_who)
```



Q2

```
regress scl sbp b1.sex b0.bmi_who

      Source |       SS       df       MS              Number of obs =    4658
-------------+------------------------------           F(  5,  4652) =   57.90
       Model |  541580.89     5  108316.178           Prob > F      =  0.0000
    Residual |  8702220.78  4652  1870.64075           R-squared     =  0.0586
-------------+------------------------------           Adj R-squared =  0.0576
       Total |  9243801.67  4657  1984.92628           Root MSE      =  43.251

------------------------------------------------------------------------------
         scl |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         sbp |   .3668708   .0291932    12.57   0.000     .3096382    .4241034
             |
         sex |
         Men |          0  (base)
       Women |   3.074562   1.301158     2.36   0.018     .5236762    5.625449
             |
     bmi_who |
       10-   |          0  (base)
      18.5-  |   10.75396   5.228957     2.06   0.040     .5027258     21.0052
       25-   |   19.80449   5.278602     3.75   0.000     9.455924    30.15305
       30-   |    19.9348   5.499011     3.63   0.000     9.154133    30.71547
             |
       _cons |   162.4893   6.239769    26.04   0.000     150.2564    174.7222
------------------------------------------------------------------------------
```


Q2

. . cisd

SD(error): 43.250905
95% CI: (42.389716 ; 44.148065)

. regeq
estimated equation
162.4893 +0.3669 * sbp +3.0746 * 2.sex +10.7540 * 1.bmi_who ///
+19.8045 * 2.bmi_who +19.9348 * 3.bmi_who

equation
b0 + b1 * sbp + b2 * 2.sex + b3 * 1.bmi_who + b4 * 2.bmi_who ///
+ b5 * 3.bmi_who

Q3

scl	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
sbp	**.3668708**	**.0291932**	**12.57**	**0.000**	**.3096382**	**.4241034**
sex						
Men	0	(base)				
Women	3.074562	1.301158	2.36	0.018	.5236762	5.625449
bmi_who						
10-	0	(base)				
18.5-	10.75396	5.228957	2.06	0.040	.5027258	21.0052
25-	19.80449	5.278602	3.75	0.000	9.455924	30.15305
30-	19.9348	5.499011	3.63	0.000	9.154133	30.71547
_cons	162.4893	6.239769	26.04	0.000	150.2564	174.7222

`sbp`: the expected difference in `scl` between two persons of the same gender and in the same bmi group who differ one unit of `sbp`.

`sbp`: the expected difference in `scl` between two persons who differ one unit of `sbp`, "adjusted" for gender and bmi group in a model without interaction.

Q3

scl	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
sbp	.3668708	.0291932	12.57	0.000	.3096382	.4241034
sex						
Men	0	(base)				
Women	3.074562	1.301158	2.36	0.018	.5236762	5.625449
bmi_who						
10-	0	(base)				
18.5-	10.75396	5.228957	2.06	0.040	.5027258	21.0052
25-	19.80449	5.278602	3.75	0.000	9.455924	30.15305
30-	**19.9348**	**5.499011**	**3.63**	**0.000**	**9.154133**	**30.71547**
_cons	162.4893	6.239769	26.04	0.000	150.2564	174.7222

`bmi_who = 30- (3.bmi_who)`:

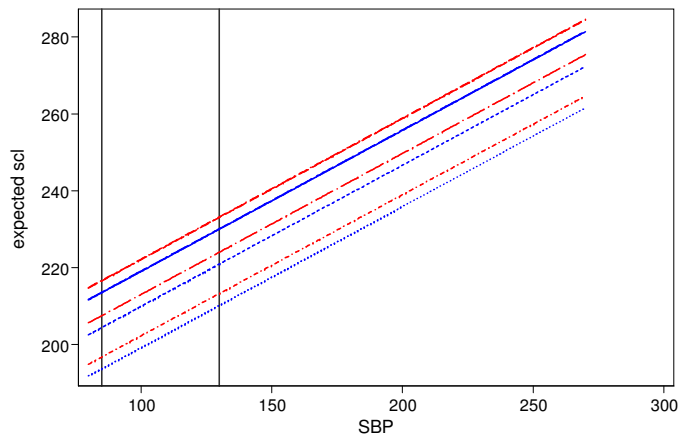
the expected difference in `scl` between a **obese** (BMI>30 kg/m^2) person and a **underweight** person, "adjusted" for gender and blood pressure.

Q3

scl	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
sbp	.3668708	.0291932	12.57	0.000	.3096382	.4241034
sex						
Men	0	(base)				
Women	**3.074562**	**1.301158**	**2.36**	**0.018**	**.5236762**	**5.625449**
bmi_who						
10-	0	(base)				
18.5-	10.75396	5.228957	2.06	0.040	.5027258	21.0052
25-	19.80449	5.278602	3.75	0.000	9.455924	30.15305
30-	19.9348	5.499011	3.63	0.000	9.154133	30.71547
_cons	162.4893	6.239769	26.04	0.000	150.2564	174.7222

`Women (2.sex)`: the expected difference in `scl` between a woman and a man "adjusted" for blood pressure and bmi group.

Q3



Q4

```
lincom _cons+sbp*85+2.sex+1.bmi_who
( 1)  85*sbp + 2.sex + 1.bmi_who + _cons = 0
------------------------------------------------------------------------------
         scl |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         (1) |   207.5018   1.627981   127.46   0.000     204.3102    210.6934
------------------------------------------------------------------------------
```

```
gen sbp85=sbp-85
regress scl sbp85 b2.sex b1.bmi_who
------------------------------------------------------------------------------
         scl |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       sbp85 |   .3668708   .0291932    12.57   0.000     .3096382    .4241034
         sex |
         Men |  -3.074562   1.301158    -2.36   0.018    -5.625449   -.5236762
     bmi_who |
         10- | -10.75396    5.228957    -2.06   0.040     -21.0052   -.5027258
         25- |   9.050527   1.420431     6.37   0.000     6.265808    11.83525
         30- |   9.180842   2.082415     4.41   0.000     5.098321    13.26336
       _cons |   207.5018   1.627981   127.46   0.000     204.3102    210.6934
------------------------------------------------------------------------------
```

The expected value of a woman in bmi group 1 with sbp of 85 is: **207.5 (204.3 ; 210.7) .**

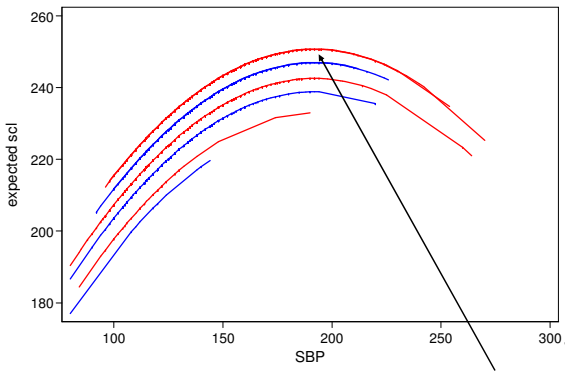
Q5

```
gen sbp2=sbp^2
xi: regress scl sbp sbp2 b1.sex b0.bmi_who
```

```
.....................................          Root MSE      =  43.095
------------------------------------------------------------------------------
         scl |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         sbp |    1.59775   .2110625     7.57   0.000     1.183967    2.011533
        sbp2 |  -.0041604   .0007066    -5.89   0.000    -.0055456   -.0027751
             |
         sex |
         Men |          0  (base)
       Women |    3.74442   1.301457     2.88   0.004     1.192948    6.295893
             |
     bmi_who |
         10- |          0  (base)
       18.5- |    9.58861   5.213895     1.84   0.066    -.6330966    19.81032
         25- |   17.67847   5.271983     3.35   0.001     7.342884    28.01406
         30- |   17.76944   5.491547     3.24   0.001     7.003407    28.53548
|
       _cons |   75.84564    15.9748     4.75   0.000     44.52746    107.1638
------------------------------------------------------------------------------
```

SD(error): 43.09523695% CI: (42.237057 ; 43.989266)

Q5



$$y = C + B \bullet x + A \bullet x^2$$
$$= C + 1.59775 \bullet sbp - 0.00416 \bullet sbp^2$$

Toppunkt ved

$$-\frac{B}{2A} = \frac{1.59775}{2 \bullet 0.00416} = 192$$

Q5

```
lincom _cons+2.sex+ 1.bmi_who+sbp*85+sbp2*85*85

( 1)  85*sbp + 7225*sbp2 + 2.sex + 1.bmi_who + _cons = 0

------------------------------------------------------------------------------
         scl |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         (1) |   194.9289   2.681602    72.69   0.000     189.6717    200.1861
------------------------------------------------------------------------------
```

The expected value of a woman in bmi group 1 with sbp of 85 is: **194.9 (189.7 ; 200.2).**

Compared to the result from model 1: **207.5 (204.3 ; 210.7)**

Q5

```
gen sbp85=sbp-85
gen sbp285=sbp85^2
regress scl sbp85 sbp285 b2.sex b1.bmi_who
```

scl	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
sbp85	.8904904	.0935662	9.52	0.000	.7070563	1.073925
sbp285	-.0041604	.0007066	-5.89	0.000	-.0055456	-.0027751
sex						
Men	-3.74442	1.301457	-2.88	0.004	-6.295893	-1.192948
Women	0	(base)				
bmi_who						
10-	-9.58861	5.213895	-1.84	0.066	-19.81032	.6330966
18.5-	0	(base)				
25-	8.089861	1.424692	5.68	0.000	5.296789	10.88293
30-	8.180834	2.081859	3.93	0.000	4.099402	12.26226
_cons	194.9289	2.681602	72.69	0.000	189.6717	200.1861

The expected value of a woman in bmi group 1 with sbp of 85 is: **194.9 (189.7 ; 200.2)**.

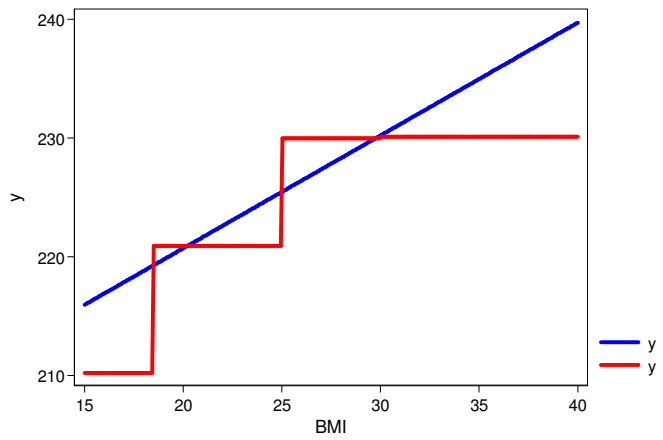
Compared to the result from model 1: **207.5 (204.3 ; 210.7)**

Q6

Variable	Model5	Model 1
sbp	.36869988	.36687077
	.02952062	.02919325
bmi	.95112584	
	.16530471	
_Isex_2	2.1519368	3.0745623
	1.2846256	1.3011578
_Ibmi_who_1		10.753961
		5.2289572
_Ibmi_who_2		19.804487
		5.2786024
_Ibmi_who_3		19.934802
		5.4990112
_cons	153.75276	162.48929
	4.8475081	6.2397689
N	4658	4658
df_r	4654	4652
F	89.305163	57.903249
rss	8740632.2	8702220.8

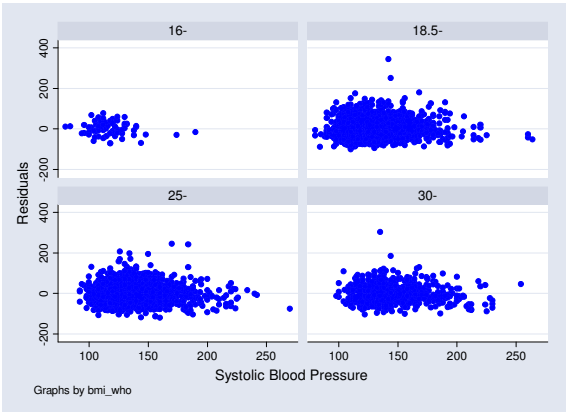
legend: b/se

Q6



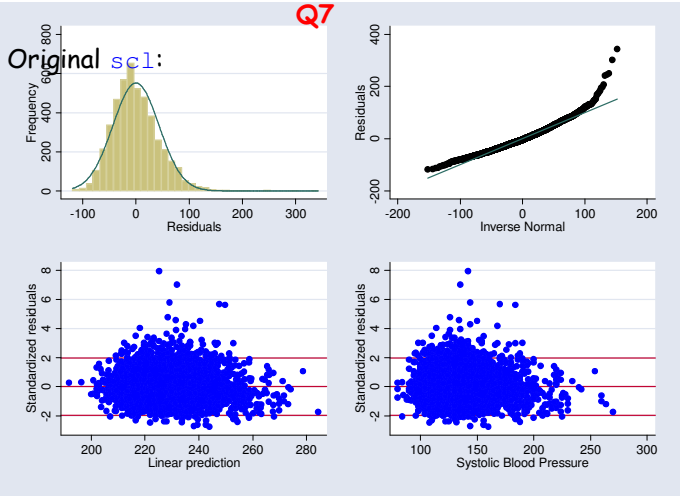
Q7

Original `scl`: residuals in bmi group for both genders.



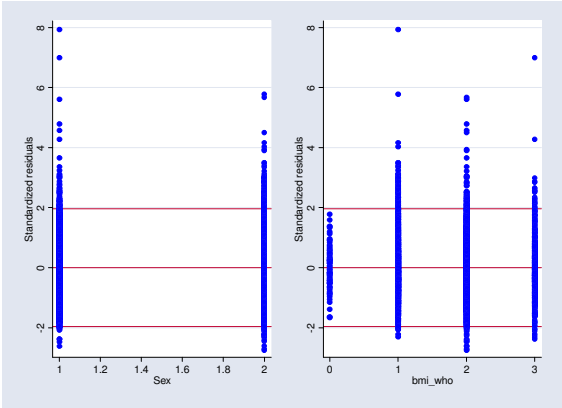
Q7

Original `scl`:



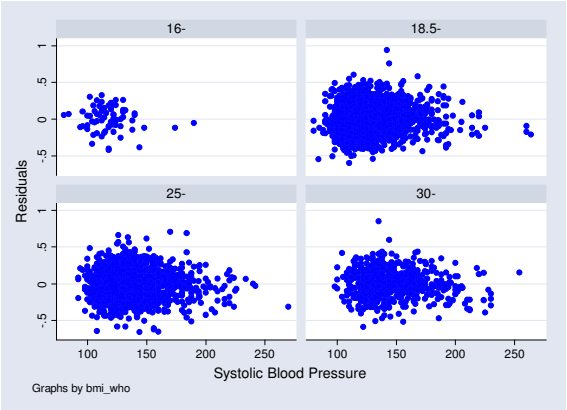
Q7

Original `scl`:



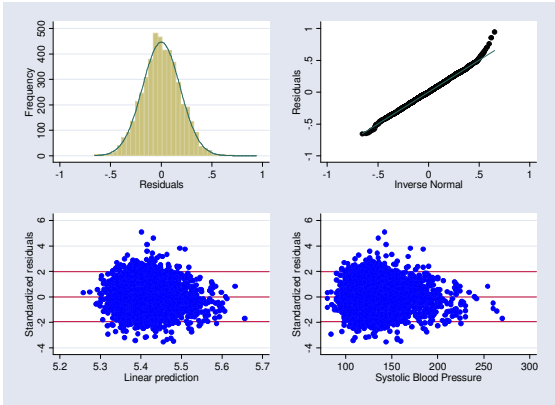
Q7

Ln transformed `scl`: residuals in bmi group for both genders.



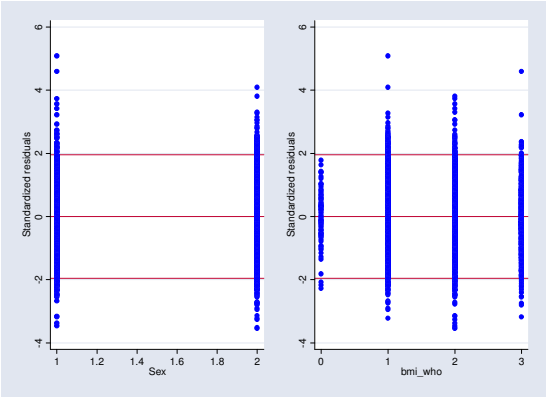
Q7

Ln transformed `scl`:



Q7

Ln transformed `scl`:




```
regress lnscl  b1.sex##c.sbp130  b1.sex##b0.bmi_who

------------------------------------------------------------------------------
       lnscl |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 sex |
         Men |          0  (base)
       Women |   .0391681   .0552838     0.71   0.479    -.0692143    .1475505
             |
      sbp130 |   .0009397   .0002133     4.40   0.000     .0005214    .0013579
             |
sex#c.sbp130 |
       Women |   .0010241   .0002636     3.88   0.000     .0005073     .001541
             |
     bmi_who |
         10- |          0  (base)
       18.5- |   .0647716   .0499277     1.30   0.195    -.0331103    .1626536
         25- |   .1059682   .0499064     2.12   0.034      .008128    .2038083
         30- |   .1219232   .0511454     2.38   0.017      .021654    .2221924
             |
 sex#bmi_who |
Women#18.5-  |  -.0275051   .0558668    -0.49   0.623    -.1370306    .0820204
  Women#25-  |  -.0288258   .0560541    -0.51   0.607    -.1387184    .0810668
  Women#30-  |   -.056727   .0577515    -0.98   0.326    -.1699473    .0564934
             |
       _cons |   5.315964   .0495131   107.36   0.000     5.218895    5.413033----
------------------------------------------------------------------------
```


Q9

The interaction `_sex#c.sbp130` is the difference in coefficient to `sbp130` between the women and men.

Lets consider the **first BMI group** (BMI on reference level):

For **men** the line is as follows:

```
logscl=5.32+0.00093*(sbp-130)
```

For **women** the line is as follows:

```
logscl=(5.32+0.039)+(0.00093+0.001)*(sbp-130)
```


Q9

The interaction `_sex#c.sbp130` is the difference in coefficient to `sbp130` between the women and men.

Lets consider the **second BMI group** :

For men the line is as follows:

```
logscl=(5.32+0.065)+0.00093*(sbp-85)
```

For women the line is as follows:

```
logscl=(5.32+0.065+0.039-.028)
                +(0.00093+0.001)*(sbp-85)
```

Q10

The interaction coefficient `2.sex#2.bmi_who` is the extra difference in level between overweight men and women compared to underweight men and women.

testparm **`i.sex#i.bmi_who`**

```
( 1)  2.sex#1.bmi_who = 0
( 2)  2.sex#2.bmi_who = 0
( 3)  2.sex#3.bmi_who = 0
      F(  3,  4648) =    1.04
           Prob > F =    0.3756
```