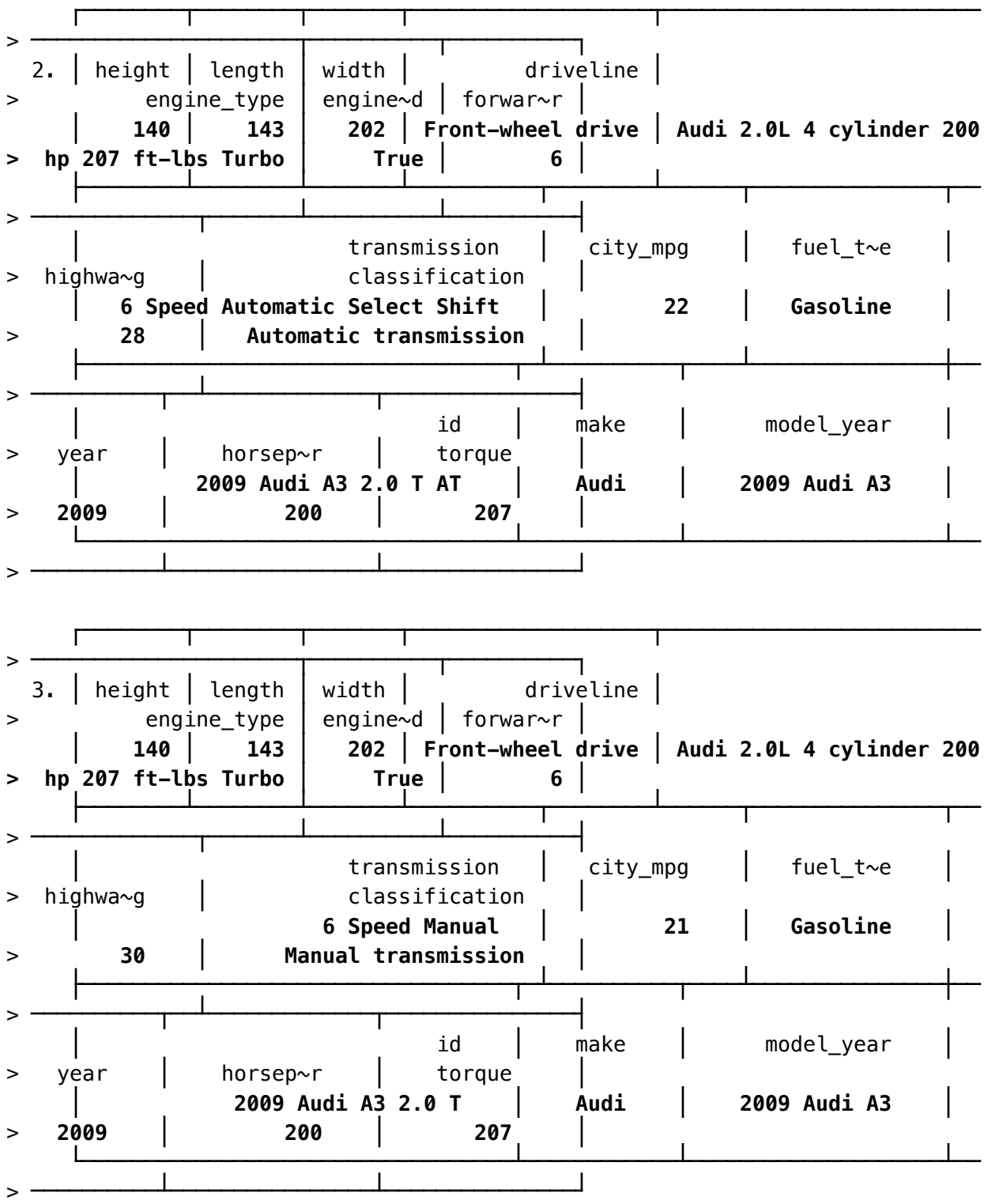
```
      name:  <unnamed>
       log:  /Users/meredithwang/Desktop/Course/STAT506/Week2/myfile.smcl
  log type:  smcl
 opened on:  26 Sep 2023, 00:54:38

1 . do "/Users/meredithwang/Desktop/Course/STAT506/Week2/STATS506_PS2.do"

2 . import delimited "/Users/meredithwang/Desktop/Course/STAT506/Week2/cars.csv
  > "
  (encoding automatically selected: ISO-8859-1)
  (18 vars, 5,076 obs)

3 . describe

  Contains data
   Observations:         5,076
      Variables:            18
  ------------------------------------------------------------------------------
  Variable      Storage   Display    Value
      name         type    format    label      Variable label
  ------------------------------------------------------------------------------
  dimensionshei~t int     %8.0g                 Dimensions.Height
  dimensionslen~h int     %8.0g                 Dimensions.Length
  dimensionswidth int     %8.0g                 Dimensions.Width
  engineinform~ne str17   %17s                  Engine Information.Driveline
  engineinform~pe str60   %60s                  Engine Information.Engine Type
  engineinform~id str4    %9s                   Engine Information.Hybrid
  engineinform~rd byte    %8.0g                 Engine Information.Number of
                                                  Forward Gears
  engineinforma~n str30   %30s                  Engine Information.Transmission
  fuelinfor~tympg byte    %8.0g                 Fuel Information.City mpg
  fuelinformati~e str22   %22s                  Fuel Information.Fuel Type
  fuelinfor~aympg int     %8.0g                 Fuel Information.Highway mpg
  identificatio~n str22   %22s                  Identification.Classification
  identificatio~d str67   %67s                  Identification.ID
  identificatio~e str18   %18s                  Identification.Make
  identific~lyear str48   %48s                  Identification.Model Year
  identific~nyear int     %8.0g                 Identification.Year
  engineinforma~c int     %8.0g                 Engine Information.Engine
                                                  Statistics.Horsepower
  v18             int     %8.0g                 Engine Information.Engine
                                                  Statistics.Torque
  ------------------------------------------------------------------------------
  Sorted by:
       Note: Dataset has changed since last saved.
```

```
  4 .
  5 . *rename the varible names
  6 .  rename (dimensionsheight dimensionslength dimensionswidth engineinformatio
  > ndriveline engineinformationenginetype engineinformationhybrid engineinform
  > ationnumberofforward engineinformationtransmission fuelinformationcitympg f
  > uelinformationfueltype fuelinformationhighwaympg identificationclassificati
  > on identificationid identificationmake identificationmodelyear identificati
  > onyear engineinformationenginestatistic v18) (height length width driveline
  >  engine_type engine_hybrid forward_number transmission city_mpg fuel_type h
  > ighway_mpg classification id make model_year year horsepower torque)

  7 .
  8 .
  9 . *3b restrict the fuel_type to gasoline
 10 . keep if fuel_type == "Gasoline"
  (485 observations deleted)

 11 . list in 1/5

      ┌─────────┬─────────┬───────┬─────────────────────┬──────────────────────────
  > ──────────────────────────────────────────┬─────────────┐
  1.  │ height  │ length  │ width │         driveline   │
  >          engine_type  │ engine~d │ forwar~r │
      │    140  │    143  │   202 │  All-wheel drive    │          Audi 3.2L 6 cyli
  > nder 250hp 236ft-lbs  │      True │        6 │
      ├─────────┴─────────┴───────┴──────┬──────────────┴───────┬───────────────┬──
  > ─────────┬──────────────────────────────┴──────────┴─────────┤
      │                     transmission  │   city_mpg      │    fuel_t~e    │
  >  highwa~g  │            classification   │
      │   6 Speed Automatic Select Shift  │        18       │    Gasoline    │
  >       25   │    Automatic transmission   │
      ├──────────────────────────────────────────────┬────────┬──────────────┼──
  > ───────┬─────────────────┬──────────────┤
      │                             id  │    make    │     model_year     │
  >   year    │     horsep~r    │    torque   │
      │               2009 Audi A3 3.2  │    Audi    │    2009 Audi A3    │
  >   2009    │        250      │       236   │
      └─────────────────────────────────┴────────────┴────────────────────┴──
  > ─────────┴─────────────────┴─────────────┘
```



	height	length	width	driveline	engine_type	engine~d	forwar~r	
2.	**140**	**143**	**202**	**Front-wheel drive**	**Audi 2.0L 4 cylinder 200 hp 207 ft-lbs Turbo**	**True**	**6**	

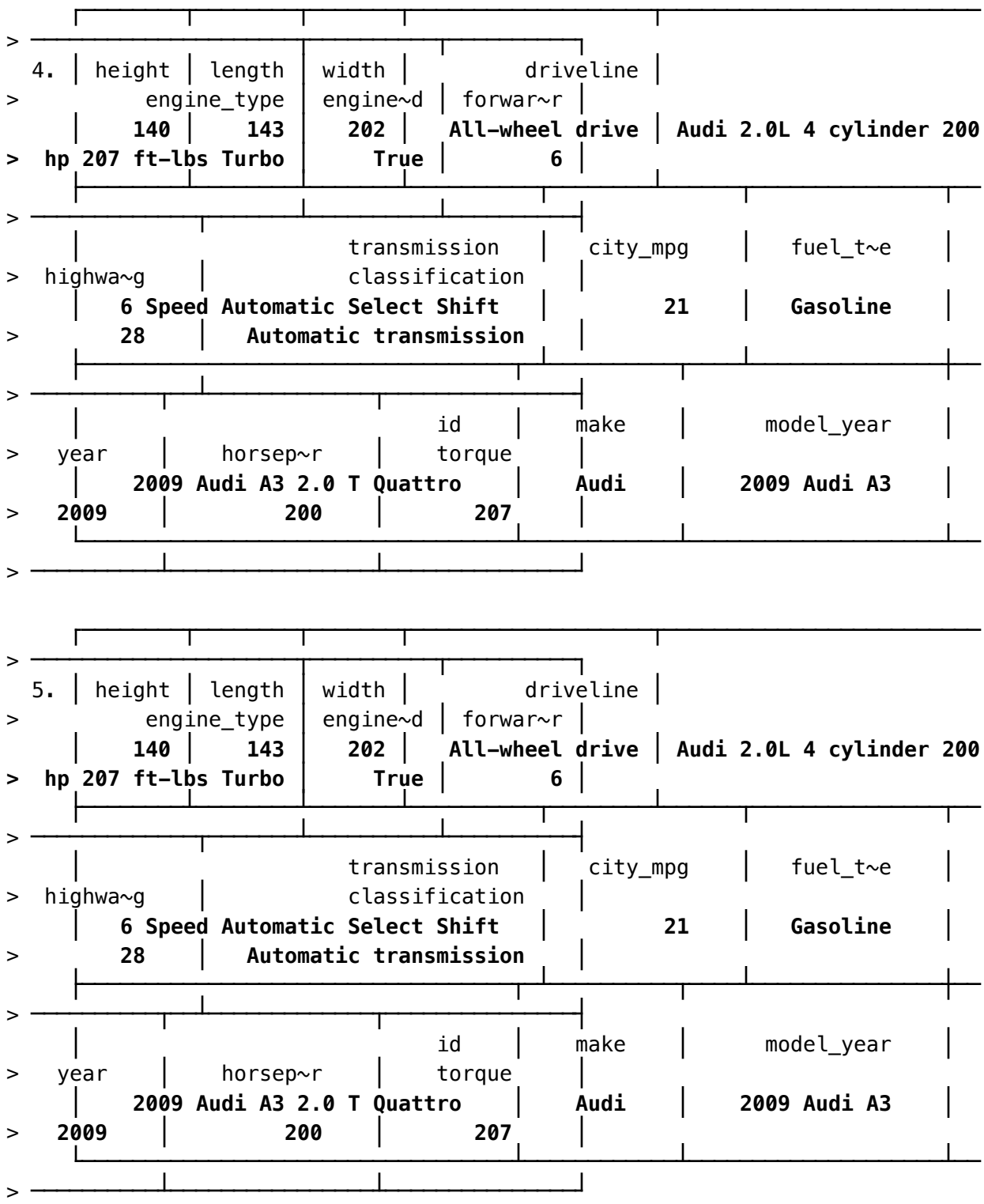
	transmission classification	city_mpg	fuel_t~e	highwa~g
	6 Speed Automatic Select Shift	**22**	**Gasoline**	**28**

	id	make	model_year	year	horsep~r	torque
	2009 Audi A3 2.0 T AT	**Audi**	**2009 Audi A3**	**2009**	**200**	**207**

	height	length	width	driveline	engine_type	engine~d	forwar~r	
3.	**140**	**143**	**202**	**Front-wheel drive**	**Audi 2.0L 4 cylinder 200 hp 207 ft-lbs Turbo**	**True**	**6**	

	transmission classification	city_mpg	fuel_t~e	highwa~g
	6 Speed Manual	**21**	**Gasoline**	**30**

	id	make	model_year	year	horsep~r	torque
	2009 Audi A3 2.0 T	**Audi**	**2009 Audi A3**	**2009**	**200**	**207**



	height	length	width	driveline	engine_type	engine~d	forwar~r	
4.	140	143	202	All-wheel drive	Audi 2.0L 4 cylinder 200 hp 207 ft-lbs Turbo	True	6	

	transmission	city_mpg	fuel_t~e	highwa~g	transmission classification
	6 Speed Automatic Select Shift	21	Gasoline	28	Automatic transmission

	id	make	model_year	year	horsep~r	torque
	2009 Audi A3 2.0 T Quattro	Audi	2009 Audi A3	2009	200	207

	height	length	width	driveline	engine_type	engine~d	forwar~r	
5.	140	143	202	All-wheel drive	Audi 2.0L 4 cylinder 200 hp 207 ft-lbs Turbo	True	6	

	transmission	city_mpg	fuel_t~e	highwa~g	transmission classification
	6 Speed Automatic Select Shift	21	Gasoline	28	Automatic transmission

	id	make	model_year	year	horsep~r	torque
	2009 Audi A3 2.0 T Quattro	Audi	2009 Audi A3	2009	200	207

```
12 .
13 . *3c
14 . regress highway_mpg horsepower torque length width height i.year

      Source |       SS           df       MS      Number of obs   =     4,59
> 1
-------------+----------------------------------   F(8, 4582)      =    413.3
> 5
       Model |  70043.6695         8  8755.45869   Prob > F        =    0.000
> 0
    Residual |   97055.298     4,582  21.1818634   R-squared       =    0.419
> 2
-------------+----------------------------------   Adj R-squared   =    0.418
> 2
       Total |  167098.968     4,590  36.4050038   Root MSE        =    4.602
> 4

-------------+------------------------------------------------------------------
> -
 highway_mpg | Coefficient  Std. err.      t    P>|t|     [95% conf. interval
> ]
-------------+------------------------------------------------------------------
> -
  horsepower |   .0163556   .0022772     7.18   0.000     .0118913      .0208
> 2
      torque |  -.0507425    .002203   -23.03   0.000    -.0550614   -.046423
> 6
      length |    .001729   .0008836     1.96   0.050    -3.36e-06    .003461
> 3
       width |  -.0003343   .0009045    -0.37   0.712    -.0021075    .001438
> 8
      height |   .0099079   .0011267     8.79   0.000      .007699    .012116
> 8
             |
        year |
        2010 |  -.4539681   .6768246    -0.67   0.502     -1.78087    .872934
> 2
        2011 |   .1711016   .6757043     0.25   0.800    -1.153604    1.49580
> 8
        2012 |   1.302928   .6810076     1.91   0.056    -.0321751    2.63803
> 1
             |
       _cons |   32.29266   .7225982    44.69   0.000     30.87602     33.709
> 3
-------------+------------------------------------------------------------------
> -
```

```
15 . /*Given that the p_value for horsepower is less than 0.05, we reject the nu
   > ll hypothesis and since the coefficient is postive, we have an increase in
   > horsepower will lead to an increase in highway_mpg. */
16 .
17 . *3d
18 . regress highway_mpg c.horsepower##c.torque length width height i.year

      Source |       SS           df       MS      Number of obs   =     4,59
   > 1
-------------+----------------------------------   F(9, 4581)      =    480.0
   > 7
       Model |  81105.8715         9  9011.76351   Prob > F        =    0.000
   > 0
    Residual |   85993.096     4,581  18.7716865   R-squared       =    0.485
   > 4
-------------+----------------------------------   Adj R-squared   =    0.484
   > 4
       Total |  167098.968     4,590  36.4050038   Root MSE        =    4.332
   > 6

------------------------------------------------------------------------------
   > ----------
     highway_mpg | Coefficient  Std. err.      t    P>|t|     [95% conf.
   >  interval]
-------------------------------------------------------------------------------
   > ----------
      horsepower |  -.0166633   .0025388    -6.56   0.000    -.0216406
   >   -.011686
          torque |  -.0860593   .0025333   -33.97   0.000    -.0910257
   >  -.0810928
                 |
c.horsepower#c.. |   .0001124   4.63e-06    24.28   0.000     .0001033
   >   .0001214
                 |
          length |   .0017767   .0008318     2.14   0.033     .0001459
   >   .0034075
           width |  -.0011694   .0008521    -1.37   0.170      -.00284
   >   .0005011
          height |   .0065604   .0010696     6.13   0.000     .0044634
   >   .0086573
                 |
            year |
            2010 |  -.5627858   .6371716    -0.88   0.377    -1.811949
   >   .6863777
            2011 |   .0725356   .6361142     0.11   0.909    -1.174555
```

```
>   1.319626
                2012 |   1.197033   .6411085     1.87   0.062    -.0598488
>   2.453915
                     |
                _cons |   42.18795   .7930274    53.20   0.000     40.63323
>   43.74266
---------------------+------------------------------------------------------------
> ----------

19 .
20 . margins, at(torque=(200(50)300) horsepower=(200(50)400) year=2009)

Predictive margins                                      Number of obs = 4,59
> 1
Model VCE: OLS

Expression: Linear prediction, predict()
1._at:  horsepower =  200
        torque     =  200
        year       = 2009
2._at:  horsepower =  200
        torque     =  250
        year       = 2009
3._at:  horsepower =  200
        torque     =  300
        year       = 2009
4._at:  horsepower =  250
        torque     =  200
        year       = 2009
5._at:  horsepower =  250
        torque     =  250
        year       = 2009
6._at:  horsepower =  250
        torque     =  300
        year       = 2009
7._at:  horsepower =  300
        torque     =  200
        year       = 2009
8._at:  horsepower =  300
        torque     =  250
        year       = 2009
9._at:  horsepower =  300
        torque     =  300
        year       = 2009
10._at: horsepower =  350
        torque     =  200
```

```
        year       = 2009
11._at: horsepower =  350
        torque     =  250
        year       = 2009
12._at: horsepower =  350
        torque     =  300
        year       = 2009
13._at: horsepower =  400
        torque     =  200
        year       = 2009
14._at: horsepower =  400
        torque     =  250
        year       = 2009
15._at: horsepower =  400
        torque     =  300
        year       = 2009
```

	Delta-method				
	Margin	std. err.	t	P>|t|	[95% conf. interval]
_at					
1	**27.16995**	**.6293933**	**43.17**	**0.000**	**25.93604**	**28.4038**
2	**23.99056**	**.6395651**	**37.51**	**0.000**	**22.7367**	**25.2444**
3	**20.81116**	**.6669751**	**31.20**	**0.000**	**19.50357**	**22.1187**
4	**27.46035**	**.6350055**	**43.24**	**0.000**	**26.21544**	**28.7052**
5	**24.56185**	**.6287161**	**39.07**	**0.000**	**23.32926**	**25.7944**
6	**21.66334**	**.6397528**	**33.86**	**0.000**	**20.40912**	**22.9175**
7	**27.75076**	**.6589761**	**42.11**	**0.000**	**26.45884**	**29.0426**
8	**25.13314**	**.6361667**	**39.51**	**0.000**	**23.88595**	**26.3803**
9	**22.51553**	**.6298357**	**35.75**	**0.000**	**21.28075**	**23.7503**
10	**28.04116**	**.6994202**	**40.09**	**0.000**	**26.66996**	**29.4123**
11	**25.70443**	**.6612986**	**38.87**	**0.000**	**24.40797**	**27.000**

```
> 9
          12  |   23.36771   .6380314    36.62   0.000     22.11686    24.6185
> 6
          13  |   28.33156   .7536904    37.59   0.000     26.85396    29.8091
> 5
          14  |   26.27573   .7022162    37.42   0.000     24.89904    27.6524
> 1
          15  |    24.2199    .663669    36.49   0.000     22.91879    25.5210
> 1
              |
------------------------------------------------------------------------------
> -

21 .
22 . marginsplot, xdim(horsepower)

  Variables that uniquely identify margins: torque horsepower

23 .
24 .
25 .
26 .
  end of do-file

27 . log close
      name:  <unnamed>
       log:  /Users/meredithwang/Desktop/Course/STAT506/Week2/myfile.smcl
  log type:  smcl
 closed on:  26 Sep 2023, 00:54:52
-------------------------------------------------------------------------------
```