```
-----------------------------------------------------------------------------------------------
      name:  <unnamed>
       log:  C:\Drive_D\Jason\workshop\multiple imputation\2024\codes_2024.log
  log type:  text
 opened on:  17 Jun 2024, 11:53:13.
.
. ********************************
. * Change the working directorySault Ste. Marie, Ontario, Canada
. ********************************
.
. cd "C:\Drive_D\Jason\workshop\multiple imputation\2024"
D:\Jason\workshop\multiple imputation\2022

.
.
.
. ***************************************************************************************
. * Use a Stata data file with an arbitrary missing-data pattern (p.220 of Stata Manual)
. ***************************************************************************************
. use https://www.stata-press.com/data/r17/mhouses1993, clear
(Albuquerque home prices Feb15-Apr30, 1993)

.
.
. *******************************************************
. * Examine the patterns of missing variables in the data
. *******************************************************
.
. misstable pattern

   Missing-value patterns
     (1 means complete)

              |   Pattern
    Percent   |  1  2
  ------------+-------------
       56%    |  1  1
              |
       35     |  1  0
        7     |  0  0
        2     |  0  1
  ------------+-------------
      100%    |

  Variables are  (1) tax  (2) age

. misstable sum, all
                                                               Obs<.
                                                +------------------------------
               |                                | Unique
      Variable |     Obs=.     Obs>.     Obs<.  | values        Min         Max
  -------------+--------------------------------+------------------------------
         price |                           117  |     99        540        2150
          sqft |                           117  |    104        837        3750
           age |        49                  68  |     30          1          53
     nfeatures |                           117  |      9          0           8
            ne |                           117  |      2          0           1
        custom |                           117  |      2          0           1
        corner |                           117  |      2          0           1
           tax |        10                 107  |     95        223        1765
  -----------------------------------------------------------------------------
```

```
. misstable nested
```

```
     1.  tax(10)
     2.  age(49)

.
.
. ************************************************************
. * Normalize the highly skewed variables with missing values
. ************************************************************
.
. sktest age tax

                    Skewness/Kurtosis tests for Normality
                                                      ------ joint ------
    Variable |        Obs  Pr(Skewness)  Pr(Kurtosis) adj chi2(2)   Prob>chi2
-------------+-------------------------------------------------------------
         age |         68      0.0002        0.1458       13.13         0.0014
         tax |        107      0.0001        0.0264       16.71         0.0002

. generate lnage = ln(age)
(49 missing values generated)

. generate lntax = ln(tax)
(10 missing values generated)

. sktest lnage lntax

                    Skewness/Kurtosis tests for Normality
                                                      ------ joint ------
    Variable |        Obs  Pr(Skewness)  Pr(Kurtosis) adj chi2(2)   Prob>chi2
-------------+-------------------------------------------------------------
       lnage |         68      0.3338        0.7194        1.10         0.5781
       lntax |        107      0.2726        0.1097        3.86         0.1452

.
. *******************************************
. *Specify the data format and varaible types
. *******************************************
. mi set mlong

. mi register imputed lnage lntax
(51 m=0 obs. now marked as incomplete)

. mi register regular price sqft nfeatures ne custom corner

. mi register passive tax age

. mi describe

  Style:  mlong
          last mi update 13jun2022 11:33:21, 0 seconds ago

  Obs.:   complete            66
          incomplete          51  (M = 0 imputations)
          --------------------
          total              117

  Vars.:  imputed:  2; lnage(49) lntax(10)

          passive:  2; tax(10) age(49)

          regular:  6; price sqft nfeatures ne custom corner

          system:   3; _mi_m _mi_id _mi_miss

         (there are no unregistered variables)


. save "example1.dta", replace
file example1.dta saved
```

```
.
. ******************************************************************
. * Imputation using Multiple Imputation by Chained Equations (MICE)
. ******************************************************************
.
. *****************
. *read in the data
. ******************
. use "example1.dta", clear
(Albuquerque home prices Feb15-Apr30, 1993)
.
. **********************
. * Impute the data
. **********************
. mi impute chained (regress) lnage lntax = price sqft nfeatures ne custom corner, add(20)
rseed(23)

Conditional models:
             lntax: regress lntax lnage price sqft nfeatures ne custom corner
             lnage: regress lnage lntax price sqft nfeatures ne custom corner

Performing chained iterations ...

Multivariate imputation                       Imputations =       20
Chained equations                                   added =       20
Imputed: m=1 through m=20                         updated =        0

Initialization: monotone                       Iterations =      200
                                                  burn-in =       10

             lnage: linear regression
             lntax: linear regression

------------------------------------------------------------------
                    |               Observations per m
                    |-----------------------------------------------
          Variable |   Complete   Incomplete    Imputed |     Total
-------------------+-----------------------------------+----------
             lnage |         68           49         49 |       117
             lntax |        107           10         10 |       117
------------------------------------------------------------------
(complete + incomplete = total; imputed is the minimum across m
 of the number of filled-in observations.)

. * mi impute chained (regress) lnage (pmm,knn(3))lntax = price sqft nfeatures ne custom corner,
add(20) rseed(23)
.
.
. tab1 age tax if _mi_m ==0, mis

-> tabulation of age if _mi_m ==0

   Home age |
    (years) |      Freq.     Percent        Cum.
------------+-----------------------------------
          1 |          2        1.71        1.71
          2 |          1        0.85        2.56
            .
            .
            .
         40 |          2        1.71       53.85
         41 |          1        0.85       54.70
         43 |          1        0.85       55.56
         45 |          1        0.85       56.41
         46 |          1        0.85       57.26
         53 |          1        0.85       58.12
          . |         49       41.88      100.00
------------+-----------------------------------
      Total |        117      100.00

-> tabulation of tax if _mi_m ==0
```

```
 Tax amount |
  (dollars) |      Freq.     Percent        Cum.
------------+-----------------------------------
        223 |          1        0.85        0.85
        225 |          1        0.85        1.71
          .
          .
          .

       1639 |          1        0.85       89.74
       1732 |          1        0.85       90.60
       1765 |          1        0.85       91.45
          . |         10        8.55      100.00
------------+-----------------------------------
      Total |        117      100.00

. by _mi_m: sum age tax lnage lntax if _mi_m ~=0

-------------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------
-> _mi_m = 1

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
         age |          2          10    7.071068          5         15
         tax |         41    665.9756    248.8798        223       1265
       lnage |         51    3.022248    .9008899   1.609438   5.054752
       lntax |         51    6.427765     .375489   5.407172   7.142828

-------------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------
-> _mi_m = 2

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
         age |          2          10    7.071068          5         15
         tax |         41    665.9756    248.8798        223       1265
       lnage |         51    2.921267    1.112895   1.182402   5.997126
       lntax |         51    6.412569    .3881544   5.407172   7.142828

-------------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------
-> _mi_m = 3

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
         age |          2          10    7.071068          5         15
         tax |         41    665.9756    248.8798        223       1265
       lnage |         51    3.314512    1.103918   1.280663   6.666093
       lntax |         51    6.419942    .3774007   5.407172   7.142828
```

```
.
.
.


-------------------------------------------------------------------------
-> _mi_m = 20

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
         age |          2          10    7.071068          5         15
         tax |         41    665.9756    248.8798        223       1265
       lnage |         51    3.153359    1.206266   .4527072   6.472569
       lntax |         51    6.473906    .3842498   5.407172   7.152384


.
. ****************
```

```
. * save the data
. ****************
. save "mice.dta", replace
file mice.dta saved

.
.
.
. ************************************
. *** Analyis using imputed data sets
. ************************************
.
. use mice.dta, clear
(Albuquerque home prices Feb15-Apr30, 1993)

.
.
. **********************
. * Conduct Regression Analysis
. **********************
. quietly mi passive: replace age = exp(lnage)

. quietly mi passive: replace tax = exp(lntax)

.
. mi estimate, saving(mice_result.dta, replace): regress price sqft age nfeatures ne custom
corner tax

Multiple-imputation estimates                   Imputations       =         20
Linear regression                               Number of obs     =        117
                                                Average RVI       =     0.2125
                                                Largest FMI       =     0.5121
                                                Complete DF       =        109
DF adjustment:   Small sample                   DF:     min       =      32.13
                                                        avg       =      74.46
                                                        max       =     103.04
Model F test:       Equal FMI                   F(   7,  102.7)   =      57.51
Within VCE type:          OLS                   Prob > F          =     0.0000

------------------------------------------------------------------------------
       price |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        sqft |   .2523628   .0865809     2.91   0.006      .0773634    .4273621
         age |  -.2370655   .8738794    -0.27   0.788     -2.016813    1.542682
   nfeatures |    6.18904   13.48005     0.46   0.647     -20.59321    32.97129
          ne |   6.189092   34.42526     0.18   0.858     -62.10399    74.48217
      custom |   138.5032   43.77608     3.16   0.002      51.65099    225.3554
      corner |  -68.26704   40.40571    -1.69   0.094     -148.4019    11.86777
         tax |   .6124866    .141715     4.32   0.000      .3271798    .8977933
       _cons |   125.6485   68.78702     1.83   0.071     -11.12307    262.4201
------------------------------------------------------------------------------

.
.
. **********************
. * Post-estimation test
. **********************
.
. ********************************************************************
. * Test if both age and tax both are significantly different from zero
. ********************************************************************
. mi test age tax
note: assuming equal fractions of missing information

 ( 1)  age = 0
 ( 2)  tax = 0

       F(  2,  68.4) =   11.41
            Prob > F =    0.0001.
. ****************************************************
. * Test if both the coefficients of AGE and TAX are equal
```

```
. ******************************************************
. mi estimate (diff: _b[age]- _b[tax]): regress price sqft age nfeatures ne custom corner tax

Multiple-imputation estimates                   Imputations       =         20
Linear regression                               Number of obs     =        117
                                                Average RVI       =     0.2125
                                                Largest FMI       =     0.5121
                                                Complete DF       =        109
DF adjustment:   Small sample                   DF:     min       =      32.13
                                                        avg       =      74.46
                                                        max       =     103.04
Model F test:       Equal FMI                   F(   7,  102.7)   =      57.51
Within VCE type:          OLS                   Prob > F          =     0.0000

------------------------------------------------------------------------------
       price |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        sqft |   .2523628   .0865809     2.91   0.006     .0773634    .4273621
         age |  -.2370655   .8738794    -0.27   0.788    -2.016813    1.542682
   nfeatures |    6.18904   13.48005     0.46   0.647    -20.59321    32.97129
          ne |   6.189092   34.42526     0.18   0.858    -62.10399    74.48217
      custom |   138.5032   43.77608     3.16   0.002     51.65099    225.3554
      corner |  -68.26704   40.40571    -1.69   0.094    -148.4019    11.86777
         tax |   .6124866    .141715     4.32   0.000     .3271798    .8977933
       _cons |   125.6485   68.78702     1.83   0.071    -11.12307    262.4201
------------------------------------------------------------------------------

Transformations                                 Average RVI       =     0.8351
                                                Largest FMI       =     0.4739
                                                Complete DF       =        109
DF adjustment:   Small sample                   DF:     min       =      35.66
                                                        avg       =      35.66
Within VCE type:          OLS                   max       =      35.66

         diff: _b[age]- _b[tax]

------------------------------------------------------------------------------
       price |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        diff |  -.8495521   .7975684    -1.07   0.294    -2.467629    .7685249
------------------------------------------------------------------------------

.
. mi estimate, saving(mice_result.dta, replace): regress price sqft age nfeatures ne custom
corner tax

Multiple-imputation estimates                   Imputations       =         20
Linear regression                               Number of obs     =        117
                                                Average RVI       =     0.2125
                                                Largest FMI       =     0.5121
                                                Complete DF       =        109
DF adjustment:   Small sample                   DF:     min       =      32.13
                                                        avg       =      74.46
                                                        max       =     103.04
Model F test:       Equal FMI                   F(   7,  102.7)   =      57.51
Within VCE type:          OLS                   Prob > F          =     0.0000

------------------------------------------------------------------------------
       price |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        sqft |   .2523628   .0865809     2.91   0.006     .0773634    .4273621
         age |  -.2370655   .8738794    -0.27   0.788    -2.016813    1.542682
   nfeatures |    6.18904   13.48005     0.46   0.647    -20.59321    32.97129
          ne |   6.189092   34.42526     0.18   0.858    -62.10399    74.48217
      custom |   138.5032   43.77608     3.16   0.002     51.65099    225.3554
      corner |  -68.26704   40.40571    -1.69   0.094    -148.4019    11.86777
         tax |   .6124866    .141715     4.32   0.000     .3271798    .8977933
       _cons |   125.6485   68.78702     1.83   0.071    -11.12307    262.4201
------------------------------------------------------------------------------

. mi estimate (diff: _b[age]- _b[tax]) using mice_result.dta
```

```
Multiple-imputation estimates                   Imputations       =         20
Linear regression                               Number of obs     =        117
                                                Average RVI       =     0.2125
                                                Largest FMI       =     0.5121
                                                Complete DF       =        109
DF adjustment:   Small sample                   DF:     min       =      32.13
                                                        avg       =      74.46
                                                        max       =     103.04
Model F test:       Equal FMI                   F(   7,  102.7)   =      57.51
Within VCE type:          OLS                   Prob > F          =     0.0000

------------------------------------------------------------------------------
       price |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        sqft |   .2523628   .0865809     2.91   0.006     .0773634    .4273621
         age |  -.2370655   .8738794    -0.27   0.788    -2.016813    1.542682
   nfeatures |    6.18904   13.48005     0.46   0.647    -20.59321    32.97129
          ne |   6.189092   34.42526     0.18   0.858    -62.10399    74.48217
      custom |   138.5032   43.77608     3.16   0.002     51.65099    225.3554
      corner |  -68.26704   40.40571    -1.69   0.094    -148.4019    11.86777
         tax |   .6124866    .141715     4.32   0.000     .3271798    .8977933
       _cons |   125.6485   68.78702     1.83   0.071    -11.12307    262.4201
------------------------------------------------------------------------------

Transformations                                 Average RVI       =     0.8351
                                                Largest FMI       =     0.4739
                                                Complete DF       =        109
DF adjustment:   Small sample                   DF:     min       =      35.66
                                                        avg       =      35.66
Within VCE type:          OLS                           max       =      35.66

         diff: _b[age]- _b[tax]

------------------------------------------------------------------------------
       price |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        diff |  -.8495521   .7975684    -1.07   0.294    -2.467629    .7685249
------------------------------------------------------------------------------
.
. ******************************************************
. * Test if the coefficients of AGE, TAX, and NE are equal
. ******************************************************
.
. mi estimate (diff1: _b[age]- _b[tax]) (diff2: _b[age]- _b[ne]) using mice_result.dta

Multiple-imputation estimates                   Imputations       =         20
Linear regression                               Number of obs     =        117
                                                Average RVI       =     0.2125
                                                Largest FMI       =     0.5121
                                                Complete DF       =        109
DF adjustment:   Small sample                   DF:     min       =      32.13
                                                        avg       =      74.46
                                                        max       =     103.04
Model F test:       Equal FMI                   F(   7,  102.7)   =      57.51
Within VCE type:          OLS                   Prob > F          =     0.0000

------------------------------------------------------------------------------
       price |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        sqft |   .2523628   .0865809     2.91   0.006     .0773634    .4273621
         age |  -.2370655   .8738794    -0.27   0.788    -2.016813    1.542682
   nfeatures |    6.18904   13.48005     0.46   0.647    -20.59321    32.97129
          ne |   6.189092   34.42526     0.18   0.858    -62.10399    74.48217
      custom |   138.5032   43.77608     3.16   0.002     51.65099    225.3554
      corner |  -68.26704   40.40571    -1.69   0.094    -148.4019    11.86777
         tax |   .6124866    .141715     4.32   0.000     .3271798    .8977933
       _cons |   125.6485   68.78702     1.83   0.071    -11.12307    262.4201
------------------------------------------------------------------------------

Transformations                                 Average RVI       =     0.4433
```

```
                                                Largest FMI       =     0.4739
                                                Complete DF       =        109
DF adjustment:   Small sample                   DF:     min       =      35.66
                                                        avg       =      68.21
Within VCE type:          OLS                           max       =     100.76

        diff1: _b[age]- _b[tax]
        diff2: _b[age]- _b[ne]

------------------------------------------------------------------------------
       price |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       diff1 |  -.8495521   .7975684    -1.07   0.294    -2.467629    .7685249
       diff2 |  -6.426157   34.44465    -0.19   0.852    -74.75704    61.90472
------------------------------------------------------------------------------

. mi testtransform diff1 diff2
note: assuming equal fractions of missing information

        diff1: _b[age]- _b[tax]
        diff2: _b[age]- _b[ne]

 ( 1)  diff1 = 0
 ( 2)  diff2 = 0

       F(  2,  78.0) =    0.73
            Prob > F =    0.4867

.
. ******************************************************
. * Test if the ratio of coefficients of AGE and TAX
. ******************************************************
. mi estimate (ratio: _b[age]/_b[tax]) using mice_result.dta

Multiple-imputation estimates                   Imputations       =         20
Linear regression                               Number of obs     =        117
                                                Average RVI       =     0.2125
                                                Largest FMI       =     0.5121
                                                Complete DF       =        109
DF adjustment:   Small sample                   DF:     min       =      32.13
                                                        avg       =      74.46
                                                        max       =     103.04
Model F test:       Equal FMI                   F(   7,  102.7)   =      57.51
Within VCE type:          OLS                   Prob > F          =     0.0000

------------------------------------------------------------------------------
       price |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        sqft |   .2523628   .0865809     2.91   0.006     .0773634    .4273621
         age |  -.2370655   .8738794    -0.27   0.788    -2.016813    1.542682
   nfeatures |    6.18904   13.48005     0.46   0.647    -20.59321    32.97129
          ne |   6.189092   34.42526     0.18   0.858    -62.10399    74.48217
      custom |   138.5032   43.77608     3.16   0.002     51.65099    225.3554
      corner |  -68.26704   40.40571    -1.69   0.094    -148.4019    11.86777
         tax |   .6124866    .141715     4.32   0.000     .3271798    .8977933
       _cons |   125.6485   68.78702     1.83   0.071    -11.12307    262.4201
------------------------------------------------------------------------------

Transformations                                 Average RVI       =     1.1199
                                                Largest FMI       =     0.5497
                                                Complete DF       =        109
DF adjustment:   Small sample                   DF:     min       =      28.99
                                                        avg       =      28.99
Within VCE type:          OLS                           max       =      28.99

        ratio: _b[age]/_b[tax]

------------------------------------------------------------------------------
       price |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       ratio |  -.5245539   1.678354    -0.31   0.757     -3.95721    2.908102
```

```
--------------------------------------------------------------------------------

. 
. ***************************************************
. 
. 
. 
. 
. 
. ********************************************************************
. * Imputation using multivariate normal model (MVN)
. ********************************************************************
. 
. *****************
. *read in the data
. ******************
. 
. use "example1.dta", clear
(Albuquerque home prices Feb15-Apr30, 1993)

. 
. 
. **********************
. * Impute the data
. **********************
. 
. mi impute mvn lnage lntax = price sqft nfeatures ne custom corner, add(20) rseed(23)

Performing EM optimization:
note: 8 observations omitted from EM estimation because of all imputation variables missing
  observed log likelihood =   112.1464 at iteration 48

Performing MCMC data augmentation ...

Multivariate imputation                       Imputations =       20
Multivariate normal regression                      added =       20
Imputed: m=1 through m=20                         updated =        0

Prior: uniform                                 Iterations =     2000
                                                  burn-in =      100
                                                  between =      100

------------------------------------------------------------------
                    |               Observations per m
                    |----------------------------------------------
          Variable |   Complete   Incomplete   Imputed |     Total
-------------------+-----------------------------------+----------
             lnage |         68           49         49 |       117
             lntax |        107           10         10 |       117
------------------------------------------------------------------
(complete + incomplete = total; imputed is the minimum across m
 of the number of filled-in observations.)

. tab1 age tax if _mi_m ==0, mis

-> tabulation of age if _mi_m ==0

   Home age |
    (years) |      Freq.     Percent        Cum.
------------+-----------------------------------
          1 |          2        1.71        1.71
          2 |          1        0.85        2.56
          3 |          2        1.71        4.27
            .
            .
            .
         45 |          1        0.85       56.41
         46 |          1        0.85       57.26
         53 |          1        0.85       58.12
          . |         49       41.88      100.00
------------+-----------------------------------
```

```
      Total |        117      100.00

-> tabulation of tax if _mi_m ==0

 Tax amount |
  (dollars) |      Freq.     Percent        Cum.
------------+-----------------------------------
        223 |          1        0.85        0.85
        225 |          1        0.85        1.71
          .
          .
          .
       1635 |          1        0.85       88.89
       1639 |          1        0.85       89.74
       1732 |          1        0.85       90.60
       1765 |          1        0.85       91.45
          . |         10        8.55      100.00
------------+-----------------------------------
      Total |        117      100.00

. by _mi_m: sum age tax lnage lntax if _mi_m ~=0

-------------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------
-> _mi_m = 0

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
         age |          0
         tax |          0
       lnage |          0
       lntax |          0

-------------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------
-> _mi_m = 1

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
         age |          2          10    7.071068          5         15
         tax |         41    665.9756    248.8798        223       1265
       lnage |         51    3.068994    .8872078   1.470505   4.869784
       lntax |         51    6.438456    .3687993   5.407172   7.142828

-------------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------
-> _mi_m = 2

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
         age |          2          10    7.071068          5         15
         tax |         41    665.9756    248.8798        223       1265
       lnage |         51     2.77053    1.116184   .4688766   7.032046
       lntax |         51    6.460148     .403052   5.407172   7.755703

-------------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------
-> _mi_m = 3

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
         age |          2          10    7.071068          5         15
         tax |         41    665.9756    248.8798        223       1265
       lnage |         51    2.850727     1.16971   .4243881   5.597603
       lntax |         51    6.477283    .3792646   5.407172   7.142828

-------------------------------------------------------------------------------------------------------

.
.
.
```

```
-------------------------------------------------------------------------------
-> _mi_m = 20

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+--------------------------------------------------------
         age |          2          10    7.071068          5         15
         tax |         41    665.9756    248.8798        223       1265
       lnage |         51    3.161854    1.009757   1.487378   7.113717
       lntax |         51    6.471601    .3916801   5.407172   7.142828


.
.
. ****************
. * save the data
. ****************
. save "mvn.dta", replace
file mvn.dta saved

.
.
. **********************
. * Estimating the model
. **********************
.

.
. use mvn.dta, clear
(Albuquerque home prices Feb15-Apr30, 1993)

.
. **********************
. * Conduct Regression Analysis
. **********************
. quietly mi passive: replace age = exp(lnage)

. quietly mi passive: replace tax = exp(lntax)

.
. mi estimate, saving(mice_result.dta, replace): regress price sqft age nfeatures ne custom
corner tax

Multiple-imputation estimates                   Imputations       =         20
Linear regression                               Number of obs     =        117
                                                Average RVI       =     0.4571
                                                Largest FMI       =     0.7221
                                                Complete DF       =        109
DF adjustment:   Small sample                   DF:     min       =      17.68
                                                        avg       =      67.83
                                                        max       =      99.29
Model F test:       Equal FMI                   F(   7,   94.9)   =      47.31
Within VCE type:          OLS                   Prob > F          =     0.0000

------------------------------------------------------------------------------
       price |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        sqft |   .2766459   .0958146     2.89   0.007     .0812592    .4720327
         age |  -.4829652   1.110544    -0.43   0.669    -2.819119    1.853189
   nfeatures |   6.725736   13.31512     0.51   0.615    -19.71336    33.16483
          ne |   5.149933    35.0918     0.15   0.884    -64.50671    74.80657
      custom |   139.1709   44.65217     3.12   0.002     50.50909    227.8326
      corner |  -64.86531   40.95969    -1.58   0.116    -146.1353    16.40467
         tax |   .5664649   .1557932     3.64   0.001     .2497561    .8831736
       _cons |   123.0308   69.85319     1.76   0.082    -16.04884    262.1104
------------------------------------------------------------------------------

.
.
. **********************
. * Post-estimation test
```

```
. **********************
.
. ************************************************************************
. * Test if both age and tax both are significantly different from zero
. ************************************************************************
. mi test age tax
note: assuming equal fractions of missing information

 ( 1)  age = 0
 ( 2)  tax = 0

       F(  2,  42.7) =    7.24
            Prob > F =    0.0020

.
. ******************************************************
. * Test if both the coefficients of AGE and TAX are equal
. ******************************************************
. mi estimate (diff: _b[age]- _b[tax]): regress price sqft age nfeatures ne custom corner tax

Multiple-imputation estimates                   Imputations       =         20
Linear regression                               Number of obs     =        117
                                                Average RVI       =     0.4571
                                                Largest FMI       =     0.7221
                                                Complete DF       =        109
DF adjustment:   Small sample                   DF:     min       =      17.68
                                                        avg       =      67.83
                                                        max       =      99.29
Model F test:       Equal FMI                   F(   7,   94.9)   =      47.31
Within VCE type:          OLS                   Prob > F          =     0.0000

------------------------------------------------------------------------------
       price |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        sqft |   .2766459   .0958146     2.89   0.007     .0812592    .4720327
         age |  -.4829652   1.110544    -0.43   0.669    -2.819119    1.853189
   nfeatures |   6.725736   13.31512     0.51   0.615    -19.71336    33.16483
          ne |   5.149933    35.0918     0.15   0.884    -64.50671    74.80657
      custom |   139.1709   44.65217     3.12   0.002     50.50909    227.8326
      corner |  -64.86531   40.95969    -1.58   0.116    -146.1353    16.40467
         tax |   .5664649   .1557932     3.64   0.001     .2497561    .8831736
       _cons |   123.0308   69.85319     1.76   0.082    -16.04884    262.1104
------------------------------------------------------------------------------

Transformations                                 Average RVI       =     2.2977
                                                Largest FMI       =     0.7210
                                                Complete DF       =        109
DF adjustment:   Small sample                   DF:     min       =      17.74
                                                        avg       =      17.74
Within VCE type:          OLS                   Prob > F          =      17.74

         diff: _b[age]- _b[tax]

------------------------------------------------------------------------------
       price |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        diff |   -1.04943   1.035636    -1.01   0.325    -3.227471    1.128611
------------------------------------------------------------------------------

.
. mi estimate, saving(mice_result.dta, replace): regress price sqft age nfeatures ne custom
corner tax

Multiple-imputation estimates                   Imputations       =         20
Linear regression                               Number of obs     =        117
                                                Average RVI       =     0.4571
                                                Largest FMI       =     0.7221
                                                Complete DF       =        109
DF adjustment:   Small sample                   DF:     min       =      17.68
                                                        avg       =      67.83
                                                        max       =      99.29
```

```
Model F test:       Equal FMI                   F(   7,   94.9)   =      47.31
Within VCE type:          OLS                   Prob > F          =     0.0000

------------------------------------------------------------------------------
       price |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        sqft |   .2766459   .0958146     2.89   0.007     .0812592    .4720327
         age |  -.4829652   1.110544    -0.43   0.669    -2.819119    1.853189
   nfeatures |   6.725736   13.31512     0.51   0.615    -19.71336    33.16483
          ne |   5.149933    35.0918     0.15   0.884    -64.50671    74.80657
      custom |   139.1709   44.65217     3.12   0.002     50.50909    227.8326
      corner |  -64.86531   40.95969    -1.58   0.116    -146.1353    16.40467
         tax |   .5664649   .1557932     3.64   0.001     .2497561    .8831736
       _cons |   123.0308   69.85319     1.76   0.082    -16.04884    262.1104
------------------------------------------------------------------------------

. mi estimate (diff: _b[age]- _b[tax]) using mice_result.dta

Multiple-imputation estimates                 Imputations       =         20
Linear regression                             Number of obs     =        117
                                              Average RVI       =     0.4571
                                              Largest FMI       =     0.7221
                                              Complete DF       =        109
DF adjustment:   Small sample                 DF:     min       =      17.68
                                                      avg       =      67.83
                                                      max       =      99.29
Model F test:       Equal FMI                 F(   7,   94.9)   =      47.31
Within VCE type:          OLS                 Prob > F          =     0.0000

------------------------------------------------------------------------------
       price |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        sqft |   .2766459   .0958146     2.89   0.007     .0812592    .4720327
         age |  -.4829652   1.110544    -0.43   0.669    -2.819119    1.853189
   nfeatures |   6.725736   13.31512     0.51   0.615    -19.71336    33.16483
          ne |   5.149933    35.0918     0.15   0.884    -64.50671    74.80657
      custom |   139.1709   44.65217     3.12   0.002     50.50909    227.8326
      corner |  -64.86531   40.95969    -1.58   0.116    -146.1353    16.40467
         tax |   .5664649   .1557932     3.64   0.001     .2497561    .8831736
       _cons |   123.0308   69.85319     1.76   0.082    -16.04884    262.1104
------------------------------------------------------------------------------

Transformations                               Average RVI       =     2.2977
                                              Largest FMI       =     0.7210
                                              Complete DF       =        109
DF adjustment:   Small sample                 DF:     min       =      17.74
                                                      avg       =      17.74
Within VCE type:          OLS                         max       =      17.74

         diff: _b[age]- _b[tax]

------------------------------------------------------------------------------
       price |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        diff |   -1.04943   1.035636    -1.01   0.325    -3.227471    1.128611
------------------------------------------------------------------------------

.
.
.
. ******************************************************
. * Test if the coefficients of AGE, TAX, and NE are equal
. ******************************************************
.
. mi estimate (diff1: _b[age]- _b[tax]) (diff2: _b[age]- _b[ne]) using mice_result.dta

Multiple-imputation estimates                 Imputations       =         20
Linear regression                             Number of obs     =        117
                                              Average RVI       =     0.4571
                                              Largest FMI       =     0.7221
                                              Complete DF       =        109
```

```
DF adjustment:   Small sample                    DF:     min       =      17.68
                                                         avg       =      67.83
                                                         max       =      99.29
Model F test:       Equal FMI                    F(   7,   94.9)   =      47.31
Within VCE type:          OLS                    Prob > F          =     0.0000

------------------------------------------------------------------------------
       price |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        sqft |   .2766459   .0958146     2.89   0.007     .0812592    .4720327
         age |  -.4829652   1.110544    -0.43   0.669    -2.819119    1.853189
   nfeatures |   6.725736   13.31512     0.51   0.615    -19.71336    33.16483
          ne |   5.149933    35.0918     0.15   0.884    -64.50671    74.80657
      custom |   139.1709   44.65217     3.12   0.002     50.50909    227.8326
      corner |  -64.86531   40.95969    -1.58   0.116    -146.1353    16.40467
         tax |   .5664649   .1557932     3.64   0.001     .2497561    .8831736
       _cons |   123.0308   69.85319     1.76   0.082    -16.04884    262.1104
------------------------------------------------------------------------------

Transformations                                  Average RVI       =     1.1858
                                                 Largest FMI       =     0.7210
                                                 Complete DF       =        109
DF adjustment:   Small sample                    DF:     min       =      17.74
                                                         avg       =      56.53
Within VCE type:          OLS                    Prob > F          =      95.32

        diff1: _b[age]- _b[tax]
        diff2: _b[age]- _b[ne]

------------------------------------------------------------------------------
       price |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       diff1 |   -1.04943   1.035636    -1.01   0.325    -3.227471    1.128611
       diff2 |  -5.632898   35.22648    -0.16   0.873     -75.5633     64.2975
------------------------------------------------------------------------------

. mi testtransform diff1 diff2
note: assuming equal fractions of missing information

        diff1: _b[age]- _b[tax]
        diff2: _b[age]- _b[ne]

 ( 1)  diff1 = 0
 ( 2)  diff2 = 0

       F(  2,  48.6) =    0.77
            Prob > F =    0.4665

.
. ****************************************************
. * Test if the ratio of coefficients of AGE and TAX
. ****************************************************
. mi estimate (ratio: _b[age]/_b[tax]) using mice_result.dta

Multiple-imputation estimates                    Imputations       =         20
Linear regression                                Number of obs     =        117
                                                 Average RVI       =     0.4571
                                                 Largest FMI       =     0.7221
                                                 Complete DF       =        109
DF adjustment:   Small sample                    DF:     min       =      17.68
                                                         avg       =      67.83
                                                         max       =      99.29
Model F test:       Equal FMI                    F(   7,   94.9)   =      47.31
Within VCE type:          OLS                    Prob > F          =     0.0000

------------------------------------------------------------------------------
       price |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        sqft |   .2766459   .0958146     2.89   0.007     .0812592    .4720327
         age |  -.4829652   1.110544    -0.43   0.669    -2.819119    1.853189
   nfeatures |   6.725736   13.31512     0.51   0.615    -19.71336    33.16483
```

```
          ne |   5.149933    35.0918     0.15   0.884    -64.50671    74.80657
      custom |   139.1709   44.65217     3.12   0.002     50.50909    227.8326
      corner |  -64.86531   40.95969    -1.58   0.116    -146.1353    16.40467
         tax |   .5664649   .1557932     3.64   0.001     .2497561    .8831736
       _cons |   123.0308   69.85319     1.76   0.082    -16.04884    262.1104
------------------------------------------------------------------------------

Transformations                               Average RVI       =     1.9124
                                              Largest FMI       =     0.6807
                                              Complete DF       =        109
DF adjustment:   Small sample                 DF:     min       =      20.04
                                                      avg       =      20.04
Within VCE type:          OLS                         max       =      20.04

        ratio: _b[age]/_b[tax]

------------------------------------------------------------------------------
       price |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       ratio |  -1.098728   2.373171    -0.46   0.648    -6.048432    3.850977
------------------------------------------------------------------------------

.
.
. log close
      name:  <unnamed>
       log:  C:\Drive_D\Jason\workshop\multiple imputation\2024\codes_2024.log
  log type:  text
 closed on:  17 Jun 2024, 11:53:22-------------------------------------------------------------------
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```